MACHAZINE

Volume 25- Issue 1
November 2020

Wiskunde Informatica Studievereniging 'Christiaan Huygens'

INTRODUCING THE NEW BOARD

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CONTAINING:

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Editorial

MACHAZINE
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W.I.S.V. 'Christiaan Huygens'

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Advertiser index

The Machazine exists 25 years!

That is 25 years of reporting the adventures of W.I.S.V. 'Christiaan Huygens', presenting you research projects of our students, and entertaining you with a miscellaneous collection of fun mathematics and computer science material. It is also 25 years of different compositions of this committee, who work hard for multiple years to gather these articles, making sure the design looks amazing, and keep improving the Machazine. And lastly, 25 years of students, teachers, alumni and others who are willing to clear some time in their busy schedules to write about their research or their experiences for us. Thank you!

To celebrate the birthday of this special committee we have a surprise for you in the third quarter. Furthermore, we thought that we might as well go into the next 25 years with a fresh new layout. We would love to hear what you think about it!

I have been a member of the MaCHazine since my second year of study. I wasn't interested in doing any committee other than the MaCHazine, since I love to combine my creativity with mathematics and computer science. So when the MaCHazine needed new members, I was immediately enthusiastic to participate. I started as part of the editorial staff and as comic writer. I had never created a comic before, but I saw the Machazine as an opportunity to start drawing again with a purpose. I love all the positive reactions I receive on my comics! One year later, Eva asked me to take over her role as chief editor, and I am so happy I said yes. From this year on I will try my best putting this Machazine together in my new role as chief editor, together with the amazing MaCHazine committee. I hope the Machazine will continue to exist for many more years, and it will forever be a special paper to me.

In this edition we of course pay attention to what has happened at CH, as we usually do. Only this time some traditional activities did not take place because of COVID-19. However, in this issue you can read all about the constitution drinks and dinner, the renovations of our beloved /pub and how the Freshmenday and OWEE took place. Furthermore, we present you a couple of scientific articles written by CH students on the occasion of their bachelor end project or research project. And when your brain is full of this math and computer science material, you can close the Machazine with a laugh with the memes collected by our memes commissioner Sterre.

Yours truly,

Maxime

Instagram Poll Results - @wisvch

While Loop 18.8%

For Loop 81,2%

My man Euler 50,8%

Pi for Life 49,2%

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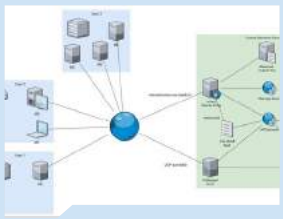

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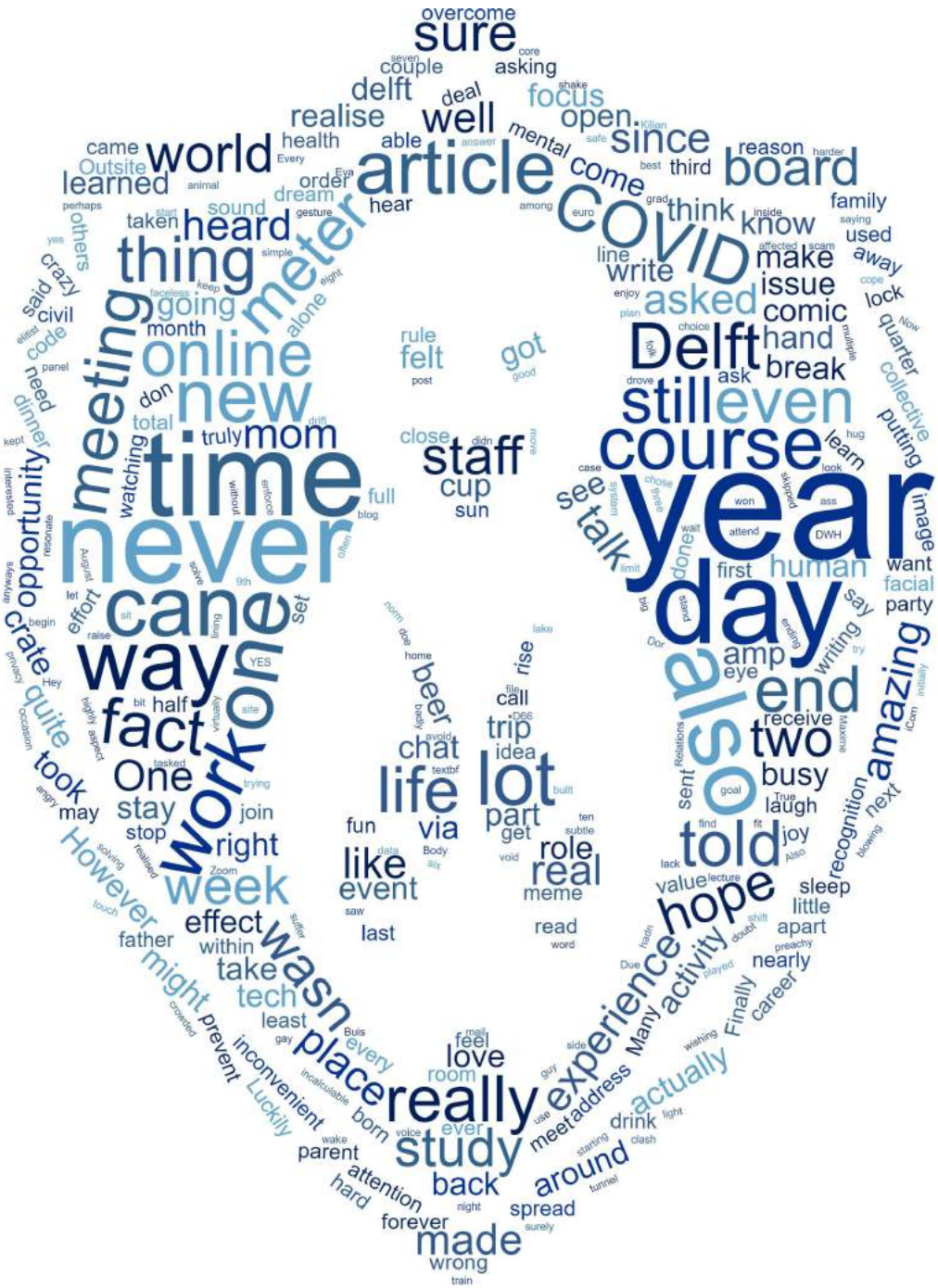
Made by: Maxime Hoekstra, Editorial Staff MaCHazine

Current Affairs



From the Board

Author: Killian Buis, Public Relations

At the time of writing this article, the first weeks have just ended. Weeks full of challenges. Not only for me, but also for all the students and staff of the TU Delft. Because this academic year is not just a regular year. Everyone has to improvise, also the board of the association.

My name is Kilian Buis and this year I will be part of the board of the study association W.I.S.V. 'Christiaan Huygens'. As Commissioner Public Relations, I am responsible for contact between the association and external parties with the goal of keeping students informed about potential career opportunities and closing sponsorship deals. Besides this, I will also be organizing the largest technical career event of the Benelux, 'De Delftse Bedrijvendagen'. Of course I am not leading the association on my own. Together with six other very enthusiastic students, we will make sure that you will have an amazing year, even in these crazy times.

Due to the COVID-19 situation, we as the board had to make some changes to the association room. We have created 7 workstations, all 1.5 meters apart from each other. In order to do this, we had to move the couches to another place. Unfortunately, this means that you can no longer come by for a cup of coffee or for a chat with one of us. But don't worry, we are working on a plan to still be able to serve you a cup of coffee and have a chat about whatever you want.

But that is enough about COVID-19. You have already heard too much about it. Let's say something about my time here at EEMCS. I started as a freshmen, not knowing anything about student life. After a couple of weeks, I was asked the join the CHoCo, the committee that organizes a freshman dinner and a parent's day. After organizing these two events, I was excited to do more within our association. Luckily, the board thought so as well and they asked me to join the MaCHazine, the committee that puts a lot of effort to create this magazine every quarter. In my third year I also organized the gala and I was part of the European study trip committee (iCom). We were busy with organizing an educative and fun trip to Stockholm. Unfortunately, the trip was canceled due to COVID-19.

Wait, I promised to not talk about COVID-19 again. Then one more note about my previous committees, especially about the MaCHazine. Unfortunately, after two amazing years, I have left the MaCHazine committee to focus completely on my board year. However, I am 100\% sure that the MaCHazine is in safe hands. During my time in the MaCHazine I have learned a lot. From asking people to write an article in the next issue, to learning how to use InDesign. These things I will definitely be using in the upcoming year.

About upcoming year, when I was a freshman I had never expected that I would stop my study for a year and focus completely on running an association. Now, recently started, I definitely do not regret that decision. I am looking forward to all the challenges that I will face this year and I am sure that we as a group will learn a lot this year.

One of the things that we have already learned, is that having an online meeting is definitely not weird. In fact, an online meeting is mostly way more efficient than an actual meeting in person. All the small talk is skipped and only important issues are discussed. Also meeting new people online was actually easier than I thought. I think this is mainly because everyone has the same struggle, and hence people are more open for it.

Of course we all hope that soon we will be able to meet in real life again. When that is possible, I want all of the readers to know that you are very welcome to visit CH for a cup of coffee/tea or for a chat with us. Because really guys, we miss you!

TU Delft News

Author: Arthur Trützschler, Editorial Staff MaCHazine

TU Delft installs new cameras to prevent further spread of coronavirus

To prevent the spread of the coronavirus on campus, TU delft has taken additional preventive measures. One of the measures is the installation of cameras on eight crowded places on campus. They are hung at a height of seven meters, to limit facial recognition, and are used to enforce the one-and-a-half meter rule. The camera images are observed by a trained staff member in the TU Delft control room and won't be saved. Security can be summoned by the staff member, in case the one-and-a-half meter rule is violated. Because facial recognition is still possible, the cameras have already brought up a lot of commotion. D66 and STIP, two parties in the municipal executive, have already voiced their doubts about the cameras. In addition, many students question the measure as privacy is infracted. Luckily it is not the intention for the cameras to stay forever, but they will stay for at least two months total. Eventually, TU Delft hopes to find a permanent solution without the need for cameras.

Figure 1. Camera Tower Near the Library. Picture: Delta TU Delft.

TU-students attempt to break world record for largest beer crate bridge

This year, civil engineering students started to build a 31-meter bridge consisting only of beer crates in order to break the world record for the largest beer crate bridge. That world record has been set by students from the TU Eindhoven by building a 26.69 meter bridge. For years, the TU Delft has been competing with the TU Eindhoven and the University of Twente for the world record. The bridge had been built by ten students who were members of 'Practische Studie', the study association for civil engineering students at the TU Delft and they had been working on building the bridge for three weeks. Finally on Thursday September 17, the bridge was finished. Unfortunately it was not meant to be: the bridge collapsed immediately after the support was released and therefore the record set by TU Eindhoven still stands. Many of the people watching are in shock: their dream is literally falling apart in front of their eyes. Why the bridge collapsed is still unclear. However, students believe that the wind may have played a role in the collapse of the bridge, since it was blowing quite hard that day, according to students on site.

Figure 2. Collapsed beer crate bridge. Picture: Omroep West.

Coming out day

On the 9th of October coming out day was celebrated in delft. On this day the moment in which gay lesbian, bisexual, transgender or queer people open up about their sexual orientation is underscored. This year at the TU Delft, Outsite, together with DWH and True U organized various activities to celebrate coming out day. Together they made sure that people on campus had a colorful day.

This year, more attention goes towards LGBTQ+ people in minority groups. Outsite organized a panel in which people from different backgrounds shared their coming out experiences. LGBTQ+ people in minority communities can have a harder time coming out, because their sexuality may clash with the norms and values of people from their minority. Coming out day is celebrated each year to help raise social acceptance of people in the LGBTQ+ community.

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[3] De Bruijn. TU Delft is installing cameras to enforce the one-and-a-half metre rule. Delta TU Delft. 28 August 2020.

[4] Commotion about the camera towers. Delta TU Delft. 07 September 2020.

[5] Van der Veldt. Coming out day: ' I won't silence myself'. Delta TU Delft. 09 October 2020.

Mental Health During a Pandemic

Author: Srinath Jayaraman, Computer Science Student

The COVID-19 pandemic has shaken the planet in a way we have not witnessed in nearly a century, and even the parents of the folks reading this article weren't born back then! The last time the world was forced into isolation and quarantine was during the influenza pandemic at the end of World War I. This time around, we have more tools in our fight against diseases. Massive strides have been made in medicinal science and our understanding of the human body has undergone tectonic shifts, giving us all hope that a vaccine might be just around the corner, putting an end to our collective global nightmare. This article is not about those things though. It is about something much more personal, something that yours truly has been experiencing for the past year, and I am writing this in the hope that it might resonate with some of you, and let you know that you are not alone.

Figure 1: Credit: The New Yorker

One of the things that has become strikingly obvious to me, and I suspect to most of us, is the fact that this pandemic has shown us just how much we took interpersonal human interaction for granted. I did not realize the profoundly negative effects isolation would have on me. I did not realize just how important collaborative work was in my overall experience as a grad student. When the lock-down was first announced back in mid-March, I (*very naively*) thought that I could deal with it. After all, it fits the stereotypical image of a programmer right? Hunched away at my desk, churning out line after line of code that no one (including myself sometimes!) really understood, but somehow just worked? Submitting assignments, attending classes and group meetings online, getting work done, it was all going to be very different, but not drastically more difficult, right?

WRONG

You see, a lot of the work of a computer science student, or really anyone in the tech arena, is indeed individual. But it tends to cloud the fact that a lot of this individualism is born from collaborative effort. I hate to sound like an elitist MBA graduate, but team-work really is at the core of everything we do. In a group assignment, sitting together at a table with the other members of my group, drinking coffee and discussing how to approach the problem that we are tasked with solving, all of this was badly affected when we were all forced to attend meetings virtually instead of in person. Only then did I realize how stimulating a physical conversation was. Body language, hand gestures, even eye movements all have subtle, incalculable effects on the way we think, and there is years of psychological and sociological research to back this up. Humans are social animals is what I am trying to say.

What happens when all this physical communication is forcibly taken away (for good reason of course)?

Loneliness

Figure 2: Credit: AZ Big Media

That's it. Loneliness. This one word encapsulates my experience better than any article or blog post ever could. Every day, I found myself feeling more and more lonely. This despite the fact that I was still very much in touch with friends and family, via Zoom or WhatsApp or what have you. I struggled to focus, struggled to code, and every online lecture felt like a never ending void of nameless, faceless voices droning on about big data, file systems, and what not. I found myself wishing, *craving,* a simple night out with my friends. Going for a drink, or just sitting by the lake, all these events felt like a utopian dream inside of a living nightmare.

The idea of going to sleep and never waking up was becoming more alluring by the day. I didn't have to suffer this alone, I could just peacefully drift off to sleep, and just... never wake up! Slowly but surely, however, I began to contemplate the idea that perhaps I was not the only one feeling this way. There *had* to be other people going through this, right? That's what all the preachy commercials were saying wasn't it? "We are all in this together". So I began to talk to my friends about this. I asked them "Do you feel like isolation just does not work for you?", and more often than not the answer was a resounding YES. Even highly introverted people were beginning to feel the effects.

You see, this isolation was not something we *chose*. In fact, it was quite the opposite, we had no choice in it. For our own well-being and for the well-being of others, especially the vulnerable ones among us, we had to stay at home and avoid interaction altogether. The mandatory aspect of this, more than anything, is what snowballed into negative implications for our collective mental health.

Many people also confided in me that they were just better students and better employees when they had the opportunity to physically work with other people. The collaboration was something that drove them, empowered them to take decisions, to solve problems, and no matter how many ``virtual meetups" they had, it did not even begin to come close to emulating real life human interaction.

I then began to ask myself, how do I overcome this? How do I help the people in my life get the better of this crippling sadness? Thankfully, there was light at the end of the tunnel, and for once, it wasn't a freight train.

Lifting the lock-down, partially

When the Dutch government announced that the lock-down would be partially lifted starting in August, I was overcome with joy. Finally, I could go out again! I could meet my friends! I could socialize (within reason of course). It was still a "new normal" but at least it wasn't complete and total isolation for months on end. I could shake hands and hug my friends again. I could sit at the same table with them, laugh, and have *bitterballen* and *kaassoufflé*!

I could (and did) also re-assess my life. I realized that the people around me were way more important to me and my mental health than I could ever imagine. And during the course of this forced isolation, the silver lining was that I also grasped what was most important to me about *myself*. To cope with the extreme loneliness, I began to read and write more and more, which is something I have not done in nearly 6 years. I began to enjoy and appreciate music in a way I hadn't since my bachelors. I understood the value of the joy in watching the sun rise, which is something I never did before.

And that's the lesson I learned - the sun will always rise. Always. You just have to wait and watch, and never stop loving the people in your life, especially yourself.

Grandscam

Author: Doris Aafjes, Mathematics Student

Doris Aafjes is a bachelor student in Applied Mathematics at TU Delft and an active member of W.I.S.V 'Christiaan Huygens'. Each quarter she writes a column about anything that's on her mind.

My grandma always comes to me or another family member when she has problems with her phone. Last time she came to me and said: "Dor, I have a problem with my phone again: I never hear it when I receive a call". I told her that on the side of the phone there is a button where you can switch the sound on and off. Of course this was just some little useful thing to know, but another time she reached out to my father for help: there was something wrong with the password of her e-mail account. My father helped her get into her account again and explained to her what he did. Then my grandma got quiet and I heard her asking: "But there is actually something I don't quite understand: what is an account?" And that's when I realized why so many things went wrong. Why she had so many Facebook accounts, why she had several e-mail addresses and why she got in trouble with her passwords that much.

The fact that my grandmother has a lot of trouble understanding technology can be a little bit inconvenient for us as the patient tech experts we are. But even more inconvenient it is for her, because it makes her vulnerable to scams. So that's what happened last week. She got a Whatsapp message from an unknown number: "Hey mom, I have a new number..." Even though my grandma has two more children and my mother's name wasn't even mentioned, my grandma immediately assumed this was my mother and she added the number to her address book. After this, "my mother" told my grandma that she had some open invoices and after that a money request of 4000 euros was sent. Quite coincidentally my (real) mother had warned her a week before. She told my grandma that she would never ask for money via Whatsapp, so she should never transfer it. Because of this my grandma initially hesitated and thought: that is crazy, she just told me she would never do that! But the person who sent the message kept insisting that he or she needed the money before 12 o'clock. So my grandma transferred the money anyways.

When I heard that this had happened, I immediately felt so sorry for her. So, I gave her a call and because of my help, she actually heard her phone ringing. On the phone she told me that she thought my mom was in real need and she just really wanted to help her. It made my heart melt that she just had the sweetest intentions. Besides that, it made me so angry that the fraudsters took advantage of that and her lack of understanding the tech. She also told me that she really thought it was my mom sending her the messages. "She talked to me exactly the way your mother always talks to me via Whatsapp. She used a heart emoticon at the end of the sentence, and that's exactly the way your mom and I always communicate!" So you can see: we are so busy securing all our online activities, but apparently a heart emoticon is already enough to break through that.

Association

The Freshmenday 2020

Author: Diederik Heijbroek, WieWie member

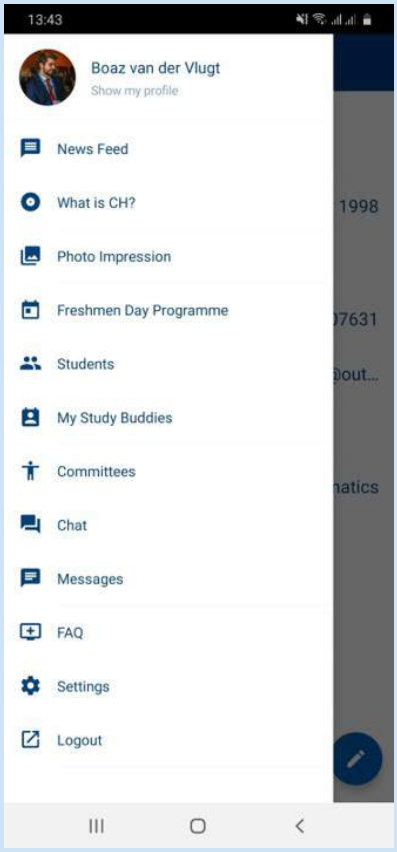
On the 18th of August, a completely different version of the Freshmen Weekend was held. Due to the coronavirus, our freshmen had to meet each other and the study association online. This brought us a lot of challenges, for instance how to create enough interaction, how the freshmen could meet each other and what kind of games they could play in order to help them bond. Before we could face all of these challenges, we had to decide on some sort of self-explanatory platform where all of these activities could take place.

Together with Let's Get Digital, we created an online platform where all of the introductory games, videos and talks about CH could take place. All registered freshmen received clear emails on how to install the app and how to launch our event. Within the platform we added a lot of information about freshmen committees and what CH had to offer, so the future students could learn more about us in advance. Next to the activities and information, there was also an additional function where students could find their study buddies. At the end of the Freshmen Day, they received an email with the contact information of their buddies to stay in touch.

One of the introductory games was called "my precious". Here, each student had to grab an object in their room and describe to each other why he or she chose the object. This was a nice icebreaker for students to talk a bit about themselves and then learn more about each other. The second game we played was "would you rather". Each student had to pick one of two options of a would you rather … question, but the questions were pretty crazy and tough. For example: Would you rather live without hot water for showers/baths or live without a washing machine? Another game was called "never have I ever." In this game, a student had to describe a situation and everyone who had done it, had to raise their hand. When someone is interested in their story, they could ask for it, so the students could share an interesting story about them. One example of a never have I ever statement is Never have I ever injured myself while trying to impress someone. In the end, the students could speed date for 1 minute per round and make their final friends.

These games were mixed with talks about CH itself and committees for freshmen. There were also three amazing coffee breaks and a video where the board gave a faculty tour. The key scene in the movie was of course the slow-motion scene where Bram drove in the CH car named Cosmo. During these talks, the freshmen could sit back, relax and answer interactive questions. The board could launch a poll where all students could vote on, so they stayed active and kept listening. We heard from a lot of students that this worked very well. There were also about 30 mentors who helped us with the activities.

In the end, we got a lot of positive feedback and a lot of students liked CH and made friends. Their enthusiasm has made our day and we look forward to meet everyone in a physical form. Spoiler alert, in February a physical form of a Freshmen Weekend will take place if everything goes well. See you soon!



The OWee 2020

Author: Lucy Westerweel, Mentor OWee 2020

Before I started studying mathematics in Delft, I did not know if I had made the right choice of study, how everything at the university works, and I was really scared I would not make any friends. Luckily, I had a lot of fun during the freshmen weekend activities and of course the parties every night! I met some amazing people with whom I formed a mentor group for the OWee. We are still really good friends to this day, so I am very glad that I participated in the freshmen weekend.

The OWee was an even bigger and longer event for all upcoming students and I really, really enjoyed the week. We got to see every student association, got to know every place in Delft and on campus we needed to know and of course joined a lot of parties! Looking back, the freshmen weekend and OWee not only helped me meet a lot of new friends, but also prepared me for my student time in Delft. During my second year in Delft I became a mentor myself and enjoyed every bit of the OWee as much as the first time.

When the Netherlands went into a lockdown in March due to Covid-19, I secretly hoped that it would not last very long, but as we all know now, this was not the case. As time progressed, it slowly became clear that all activities for the upcoming students would not be able to take place in their usual way. Since I had already been a mentor I had decided not be a mentor again in my third year, but when I got an email from the board of the OWee, basically begging people to become mentors, as there were not enough, I happily applied. Since the freshmen weekend and OWee helped me a great deal, I wanted to help the upcoming students to have the best possible experience, although the events would look totally different. After my mentor buddy Annerieke and I had gotten information about what the week would look like, we both thought that the corona proof OWee sounded more fun than we had anticipated. The organization of the OWee put in a lot of effort, by planning really carefully and even building their own app!

First, there were three online days. There were some online events that also took place during previous years, like the central opening, association forum and college tour. There were also some online activities for

the upcoming freshmen to get to know each other, like online yoga in the morning, a cooking workshop you could follow and time to lunch and talk together. I also enjoyed the online campus quest where we had to virtually enter buildings to solve several puzzles whilst getting to know Delft. The last element of the online days consisted of association TV, where each association had their own channel to for example live stream DJ sets, quizzes and interviews with members. The second part of the OWee consisted of a physical day in Delft. One part of the day would be spent visiting associations and the other part was about the campus and studying. We received a very detailed planning where we had a whopping 7.5 minutes per association! This sounds a bit lame and too short to get to know the association, but this was the only way all upcoming students would be able to visit the associations. The part on campus consisted of visiting a market where all associations had a stand where you could get information and visiting some cool places on campus. During the break the whole group could enjoy some lunch and drinks at the OWee terrace, which I think was really nice.

I thought that the OWee was really well organized and they had done their very best to make the best of it, despite the Covid-19 restrictions. I expected my mentor kids to participate in most of the activities, since they were able to have some sort of introduction week instead of noting, which was the case at some other universities. Sadly, most of the upcoming students weren't that enthusiastic which I think is because they weren't able to join all the expected parties and had to follow quite strict rules. Comparing this OWee with the previous ones, I think that the biggest downside was that there was a larger barrier to talk to someone and thus to make friends. The online environment made everything much less spontaneous and relaxed. Despite that, I really hope that I helped my mentor kids to get to know student life in Delft as much as the freshmen weekend and OWee helped me.

The /Pub Board

Author: Sam de Jong, Commisioner of inventory /Pub board

The /Pub is the faculty pub in the basement of EEMCS. Since last academic year, a board has been managing everything going on around the /Pub. This year, it's my turn, together with my fellow members of the new /Pub board, to take over from the first /Pub board and manage the beautiful /Pub!

A very long time ago, well two years ago actually, we had our "prachtige" founders who laid the foundatio for the formation of the /Pub board. They were members from both CH and ETV who contributed to norms and values we still have today. After the groundwork was done, the first /Pub board, who were just a bit less "episch" than the current /Pub board, was installed. They managed the /Pub last academic year and did a great job. Lucky for you, the fresh second somewhat more "episch" and "prominente" /Pub board has been in charge since the end of August.

The /Pub board always consists of 4 ETV'ers and 4 CH'ers, so it's well balanced between both study associations. In my board, we have our chairman Owen, our secretary Maxim, our treasurer Niels, our Commissioner of Inventory Sam (me), our Commissioner of Events Joep, our Commissioner of Maintenance Robbin, and both our QQ'ers Frederiek and Joris from the boards of CH and ETV respectively.

Now, let's start with some history and fun facts of the beautiful /Pub! Originally, the /Pub was called the E-Kafee. It had this name for 32 years until in 2003 it was renamed the /Pub, after /Public which was commonly used in Linux. Also, did you know that there used to be a "kegelbaan" in the /Pub? It was used by all members of the faculty, until it was covered up by the podium. We also are the location for some of the most iconic events of CH and ETV, for example the freshmen kick-off drinks for CH, and the "kwartjesavond" for ETV. Since last year,

we also organize our own " epische" events in the /Pub, such as the cantus, which was a great success last year, the New Year's drinks and even a special event for the Barkeepers of the /Pub!

Let me tell you about some statistics of the /Pub. Did you know that the /Pub is selling 10 times more different types of beers than snacks and sodas? And did you know that we sold around 23 thousand liters of drinks last academic year? Also, the most ordered snack are the biba's (bitterballen) and the most ordered specialty bier is Tripel Karmeliet.

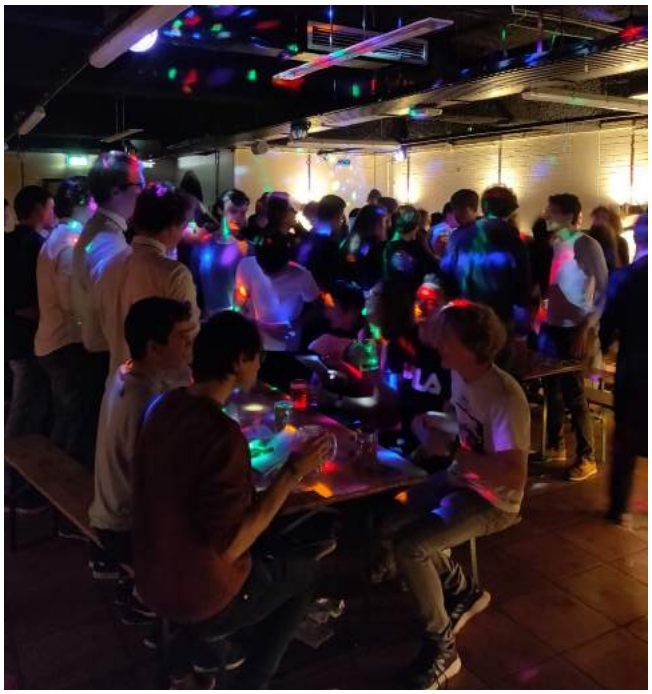
Now, something about the goals of the /Pub. As the board of the /Pub, our main goal is to take care of our precious pub. We try to maintain its beauty and renovate her if needed. You'll read more about the renovations of the /Pub and what we're focusing on getting done this year later. As the board, we are of course also responsible for the day to day management of the /Pub. These tasks include but are not limited to: making sure that the inventory is up to date, having weekly board meetings, cleaning the /Pub every quarter and organizing some "epische" events like the cantus! All these tasks are a big responsibility, but we are honored to take this task upon ourselves!

When me and the rest of the /Pub board aren't busy with our very professional weekly board meetings or tappen at the bar, we can mainly be found spread over EEMCS. Our chairman Owen is usually busy with being a proud "ETV mannetje" together with our trusty secretary Maxim and Joris the QQ'er. The treasurer Niels can be, suspiciously regularly, found together with Frederiek the QQ'er, doing something special called accounting, or drinking beer who knows. I myself am usually busy with keeping track of the inventory of the Pub, but now that the Pub isn't open, I can be found all over the place secretly pasting "Samballen" stickers to irritate the CH-board. Joep is keeping track of all the special

events that are coming up in the /Pub and being a “stroeve” negotiator with the mobitap of the /Pub, and Robbin, also of course a proud “ETV mannetje”, is always busy with managing the renovation of the Pub!

We can’t however manage the /Pub entirely on our own, which is why we are glad to have the trusty Barkeepers around to help us with the /Pub! The Barkeepers are a close group consisting of enthusiastic members of both ETV and CH who want to help the board of the /Pub by standing behind the bar some nights! As a member of the Barkeepers, you are always standing together with another member and getting to know new people on the other side of the bar! This is especially fun because you get to engage with members from both CH and ETV. Usually, you are only required to stand behind the bar once per quarter, but it is of course possible to join us more often! The board is always glad when members of the Barkeepers help, which is why we treat them well in return with their own exclusive gifts and special events! We are always looking for more excited members to join the Barkeepers, so don’t be afraid to e-mail pub-ewi@tudelft.nl, or to ask about it when you see us in the /Pub!

Due to the current circumstances, the /Pub has been closed since March, which we are all deeply sad about. However, this gave us, and the previous board, plenty of time for tasks that aren’t related to the day to day managing of the pub. We have had the time to give the entire /Pub a make-over! We started by giving the /Pub a, perhaps long needed, paint job and then started to rebuild the smoking area. This room was then used to create a small storage room and an “epische” official office for the /Pub board. Also, we are busy with designing a brand-new bar for the /Pub. During our grand reopening, which is hopefully soon, we will reveal this brand-new bar to you! So, when we’ve finally opened our doors again, don’t forget to join us in the /Pub!



While we’re on the topic of our grand reopening, this is exactly what we’ve been busy with the last couple of days. We are preparing an “anderhalvemeterplan” for the /Pub, which mainly consists of stealing tables and chairs from other faculties, trying out each kind of disinfectant gel we can find and putting tape all over the floor of our precious /Pub. Lately, we have also been waking up all the members of the Barkeepers from their hangover and started working on new events for the /Pub. Just a little sneak peak, these events will start after our reopening and will feature some friendly rivalry between both study associations CH and ETV.

Finally, I would like to share my personal experience with you about being a part of the /Pub board. Since the beginning of August, I’ve been busy, together with my members of the board, with the transmission from the first board. We were all introduced to our roles by the previous board members and made our very own /Pub board policy. I’ve especially enjoyed the great responsibility that comes with being the /Pub board. With committees, there was always a preconceived plan for your activities to follow. However, now that I’m part of /Pub board, I’ve been able to start whatever project I think will help the /Pub. As the /Pub board consists of members from both study associations, it’s fun to get to know the ETV members better. The freedom and responsibility I’ve felt is the reason that being the /Pub board is truly the most wonderful experience I’ve ever done within Christiaan Huygens!

Constitution Drinks and Dinner

Author: Max Le Blansch, Board 64

On Monday, the 31st of August, the first General Assembly of the new year took place, where the 63rd board made place for the 64th board with their emotional speeches. Afterwards the traditional Constitution Drink took place. Normally, this drink is very busy where a lot of other boards of the nieces of CH congratulate the new board. Unfortunately, with all of the current regulations, the drink had to take place in a very different way at a different place.

Instead of everyone being able to attend if they would want, we - the new board - had to invite a maximum of 120 who were allowed to congratulate us in shifts of 12 people. Because of this limit, we could not invite the nieces of CH. Eventually we filled all the slots with close friends, family, housemates and previous boards of CH.

These 12 shifts each had a different arrival time assigned, at which they were expected to be present where they could wait underneath one of the 3 waiting tents. Here, they would be served some drinks. Each shift also had their own time of congratulating the board assigned. At that time, they were called forward to enter the tent in which we were present where everyone was able to stand with 1.5 meters distance of everyone. Each shift had a total of 10 minutes to give a little speech, congratulate us, give us a gift or even sometimes drink a shot with us.

We as the board were traditionally dressed in white blouses, a vest in the colour of our board, which is midnight blue, and a black tailcoat. Underneath the vests the men wore a green CH board tie and the ladies wore a green CH board choker.

For me personally, one entire shift was filled with my housemates, which was a lot of fun. They posed a challenge to us as a board with 10 really hard questions where we were rewarded when they were answered correctly. One of the final shifts was filled with a lot of parents of different

board members. For me, only my father was able to attend. It was a new way for him to see what my student life here in Delft was like, which he really enjoyed.

The entire drink lasted from 17:00 to 19:00, after which we had an hour before we had to be at 't Koningshuys in the centre of Delft. During the time in between of the drink and the dinner the Chairman of the new board had to be shaved completely bald, as is tradition. Out of solidarity, we - the rest of the guys of the new board - also agreed to completely shave our hair off. Unfortunately, there wasn't enough time for all of us to finish the shaving on time, which meant we all had some uneven spots on our head which wasn't a pretty look.

Fortunately, we managed to arrive at the restaurant in time. Here, the entire first floor of the restaurant was reserved for everyone: us, the old board and every member who bought a ticket. This meant a total of around 35 people attended the dinner. The restaurant had organised the dinner very well, everyone was able to keep enough distance to each other. Everyone had to fill in a form beforehand to choose what appetizer, main course and dessert they wanted which all included vegan options. I really enjoyed the meal, it tasted very good and I had a good time hangout out with the people present.

When the dinner was finished, I headed home thinking the evening was done. I couldn't have been more wrong. When I arrived at home, I found out my housemates completely trashed my room, as is tradition in some student houses in Delft. They put my bed on 6 crates of beer, threw everything that was on my floor on the bed and filled the floor with plastic cups of water and soap. A lot of these cups were placed upside down still with water and soap in them, which guaranteed a flood in my room when I would clean them up. I didn't even try to clean it up that evening and ended up sleeping in the bed of a housemate that wasn't home. The next day it nearly took me 5 hours to get my room back to normal, but at least the floor of my room was very clean afterwards.

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Meet over 150 national and international companies at the career fair. These companies rank from consultancy to engineering. At the Orientation Days days you can orientate yourself by attending presentations or visiting info stands. Come to the Aula or the online fair to see all of them.

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22 - 26 March 2021

The Coffee Dates is an approachable event where you have the opportunity to get to know a company over some coffee. Companies select the students they want to get in touch with beforehand, based on your resume. The conversations will take 20 minutes and will take place at a coffee bar or online.

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26 April - 11 May 2021

In-house Days offer an opportunity to form a better, more complete idea of the companies you are interested in. Your resume will be forwarded to the companies of your choice. Based on the resumes the companies will select the participants.

HOW TO JOIN

You can sign up at the website ddb.tudelft.nl, starting on the 4th of January, till the 21st of February. Visit the website for more information!

DE DELFTSE 2021 BEDRIJVENDAGEN

JOBS / INTERNSHIPS / GRADUATION PROJECTS

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Wiskunde Informatica Studievereniging 'Christiaan Huygens'

101 Online Symposium

Advanced Analytics: Diving Deep into your Data

November 19th

19:00-19:10
Opening by Eva de Valk

19:10-19:50
Marcel Worring

19:50-20:30
Dimitris Rizopoulos

20:30-20:35 Break

20:35-21:15
Jeroen van den Hoven

21:15-22:00 Panel with
Ronald Prins
Jeroen van den Hoven
Wouter Welling
Vincent Warmerdam

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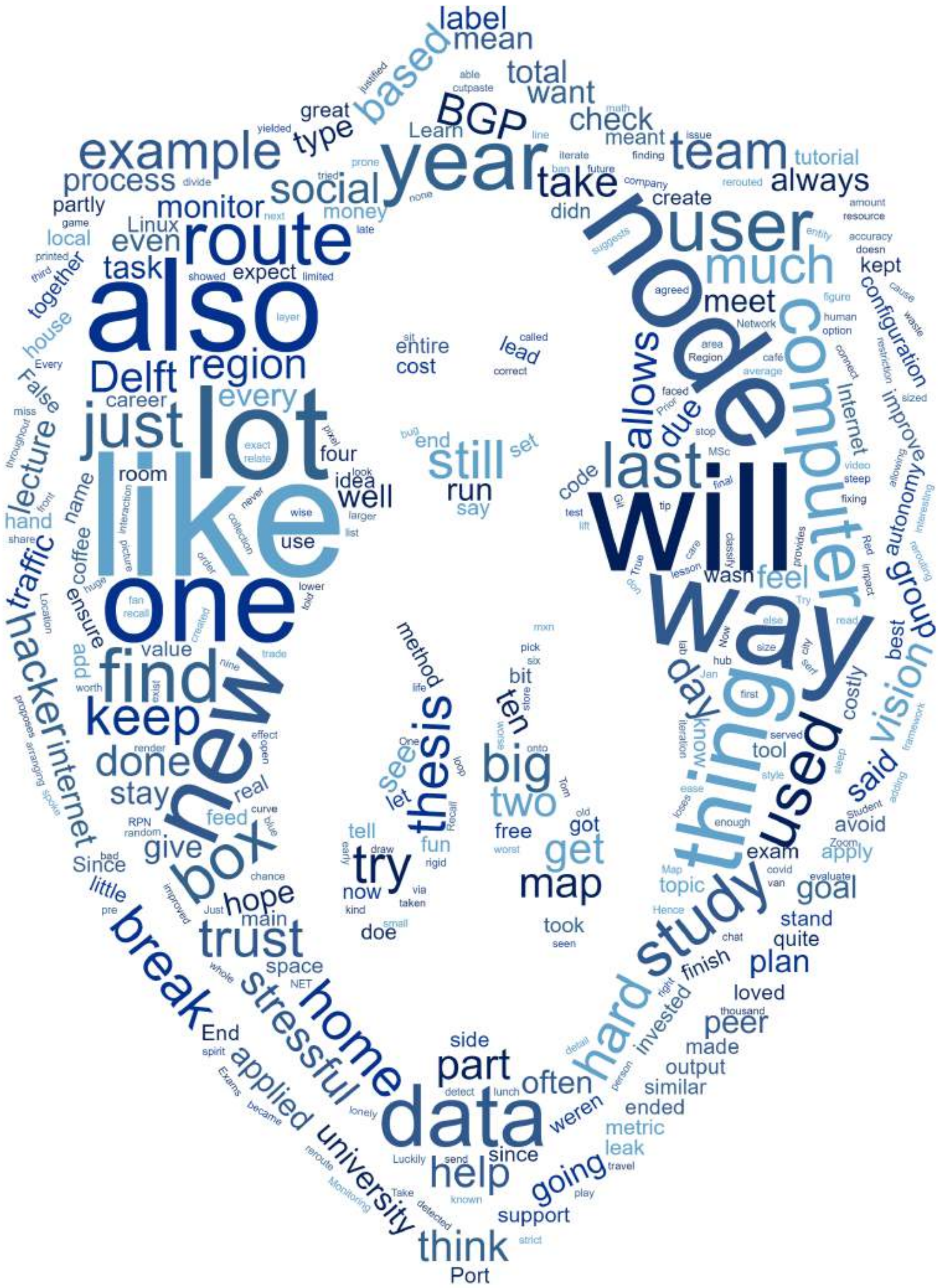
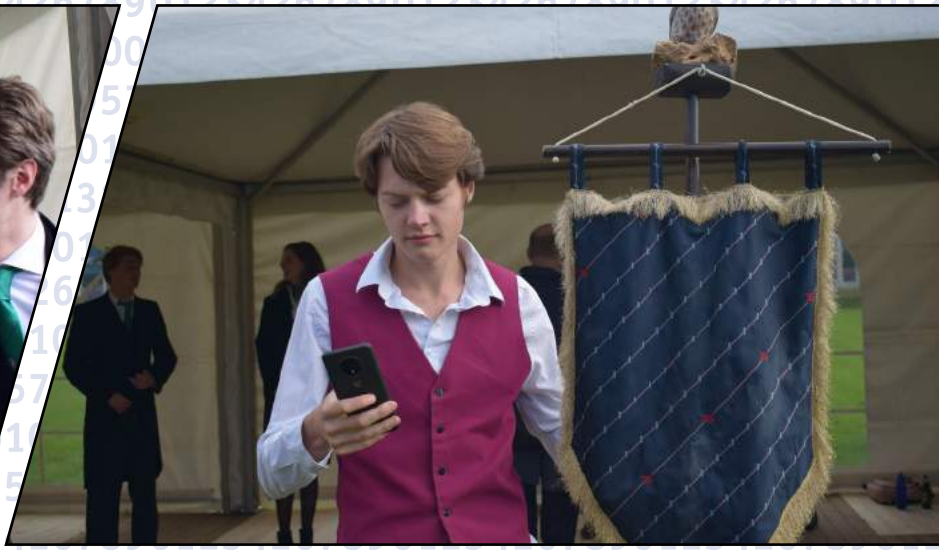
TU Delft R.Timman Stichting

Computer Science














Global Monitoring and Visualization of the Internet

Author: Tom Saveur, MSc Student Computer Science

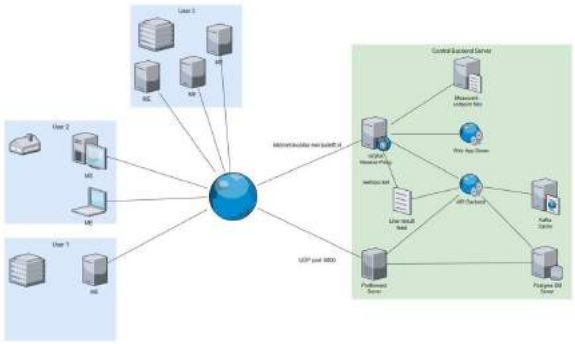
The internet consists of many networks connected by the Border Gateway Protocol (BGP) and can easily be manipulated by a hacker. Every day, hackers reroute internet traffic and use that to impersonate entities such as companies, devices and humans. To detect this rerouting, which is also known as a route leak, a BGP monitor can be used. A BGP monitor checks whether the local route is correct by comparing the local route to the route from hundreds of devices. The lower the percentage of the routes that are the same, the bigger the chance there is a route leak. Hence, a user can tell whether a hacker manipulated the route. For the Bachelor End Project, we decided on developing a BGP monitor application, that will ease the process of finding whether a hacker rerouted a part of the internet. To achieve this, the Internet Monitor (IM) application has been developed.

The IM application consisted of 3 different parts.

- Backend
- Nodes
- Visualization

Backend

The backend was created in C# using the .NET framework. And it serves various purposes. For one it was a central point to which the Nodes could connect. It also allowed for various administration tools for the nodes. And finally, it served as a central data collection hub, all nodes send their data to the Backend, which stores it in a database. It also feeds data to the visualization part through a WebSocket, which allows for fast visualizing of data.



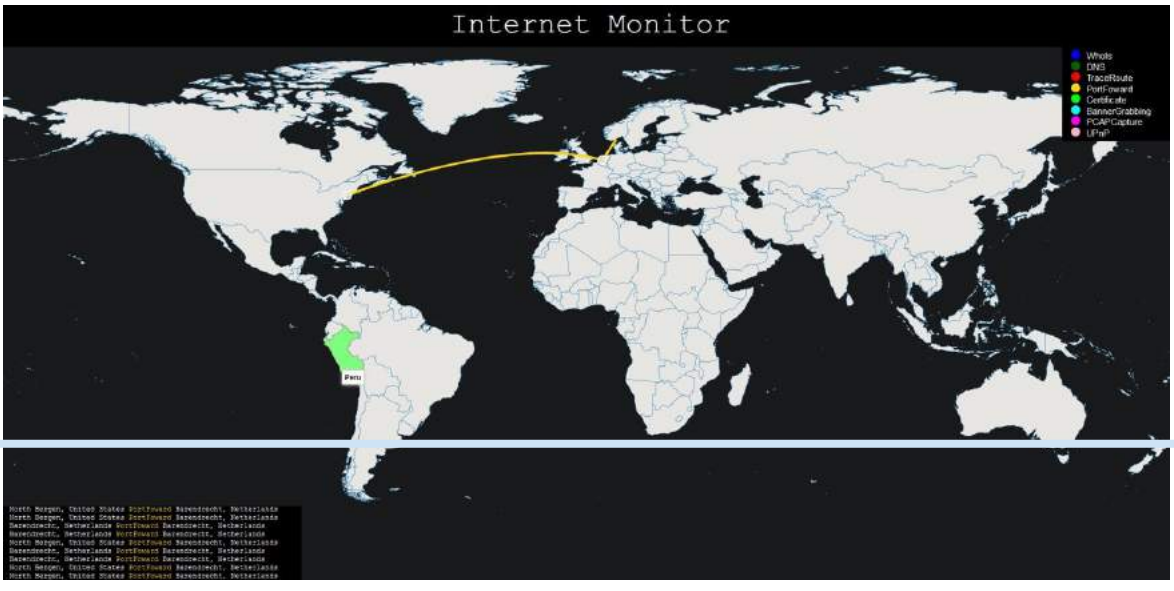
Nodes

The implementation for the nodes consists of a program written in Golang. This program can be installed on various operating systems, like Windows, OSX and Linux. The most important of these operating systems is, of course, Linux, since it allows the users that want to do measurements to run these nodes from raspberry pi's. The nodes have one main purpose, which is the execution of tasks that it receives from the Backend. There are several tasks that these nodes can perform, namely: DNS, WHOIS, Port Forward, Traceroute, PCAP Capture, UPnP Port Opening, Banner Grabbing, and Certificate Grabbing.

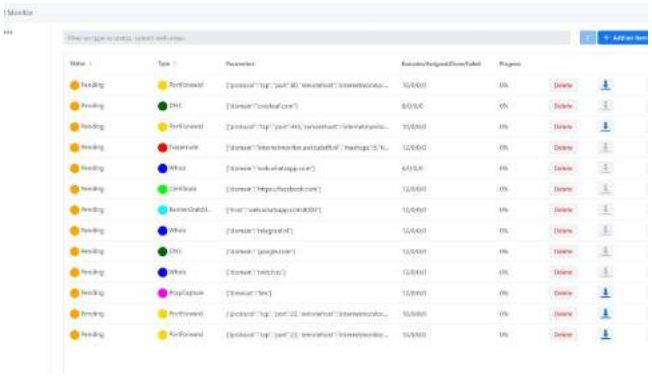
Visualization

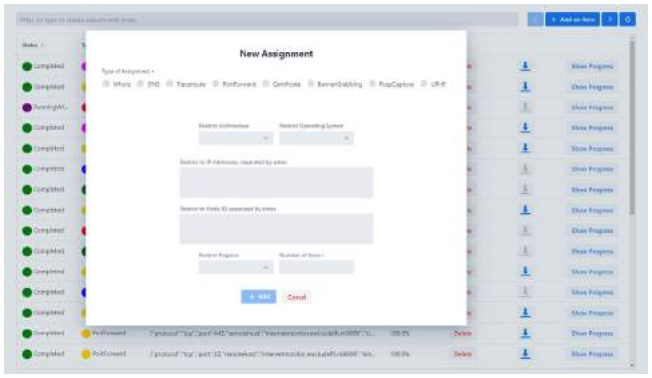
The visualization is the part of the program that will allow the various backend requests to be made. This is done by creating a UI in both Java and JavaScript/HTML. For the visualization there are two parts, a map screen and several configuration screens. The map screen was a feature based on the Kaspersky[1] cyber map, which is a great tool for visualizing various types of attacks. It will show the locations of the node, and a line based on the assignment towards another location. This map screen was made in such a way that it is appealing to normal users to see what is happening, without a lot of knowledge on what each task actually means.

1 *https://cybermap.kaspersky.com/*



The configuration screen, on the other hand, was more focussed towards users that have nodes or administrators that would like to administrate the process. A user that only has nodes (no admin rights) can change various things about said node, like the name or what types of assignment it allows a node to do and it allows the user to see what assignments the node has been running, together with a result and status. An Admin can manage assignments, view the process of the various assignments, download results and control a blacklist. This blacklist is based on either IP or Location. So, it can ban users from running anything based on their location, should this be necessary.





Process

As with all big Computer science projects we started with setting up the Git and arranging meeting times with both our supervisor and client. But this time everything was different, we could no longer meet in person due to an up and coming Corona Virus. But luckily it did not change a lot, because by using various means of conversation we could still have meetings. Sometimes not having physical meetings was also a lot better. A lot of our meetings with the supervisor were very quick, and having to travel to the university for just a meeting of 15 minutes would be a huge waste of time.

But after creating the meeting schedule, we divided ourselves up into 3 teams, one team for each component. And got working. While I focussed mainly on the Visualization and the report, my other team mates were focussing on the Backend and the Nodes. And within these teams we tried to work out and plan the various requirements given to us by the client, but you might have guessed it already; the client kept on requesting new features, which spoiled the party unfortunately. So even in the last couple of weeks we kept on working on newly requested features, while also bug testing the old ones. Which, of course, caused a lot of stress for the entire team.

But after a lot of crunching we delivered a product that we were satisfied with. And while there were a lot of things we could and would have done given more time, we unfortunately had to stop development after the BEP was over.

So, to end this, I'd like to give some tips to people that will soon start working on their Bachelor End Projects (or Research Projects) to hopefully avoid some of the more stressful situations.

1. **Ensure that the client trusts your opinion** – By ensuring that you keep the meetings and conversations very professional will ensure that the client will start to trust you more and more. Which ensures that he will be more likely to agree with you on certain things, which leads into the second point.

2. **Learn to say no** – Working on a project like this can be very stressful, especially when the new request, that, trust me, will cost way more time than the 10 weeks or so you have to finish the project. Learn to say no, but do it in a way so the client will believe and trust you. Explain that you do not have time for this and that, should he still want it, it will cause problems for other features.

3. **Start early** – Easier said than done, especially when working from home.

4. **Take your breaks** – As someone that regularly works from the morning until late in the night, trust me, take your breaks. This is again something that is easier said than done when working from home, since you can not go to the University to work, and have your home to relax. Which leads into the next point.

5. **Separate work and relaxing** - Try to create a space for working, and a space for relaxing; you will notice that it will greatly improve your overall efficiency.

Goodluck to all!

Tom

A Bachelor Thesis Centered Around LEGO

Author: Hiba Abderrazik, Student Computer Science

Computer vision is currently being applied to many different areas. From the medical field to traffic and autonomous vehicles. Most computer vision algorithms have in common that they are tested and applied to scenes with large, recognizable objects. During my bachelor thesis I investigated how I could apply existing algorithms for object detection to new datasets containing LEGO bricks, which are very similar in shape, size and sometimes color.

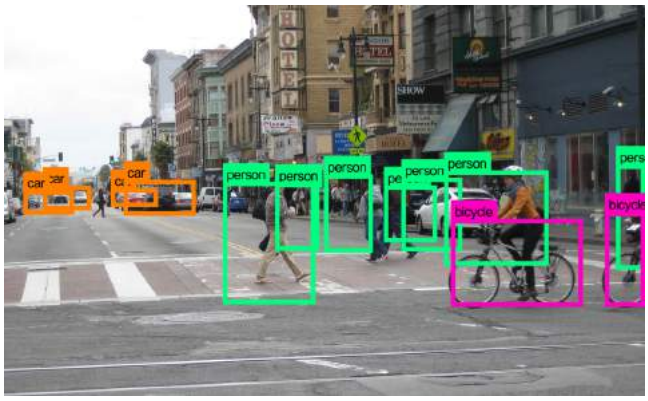
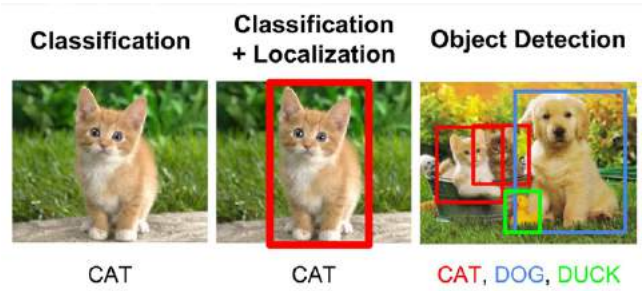


Figure 1: An application of computer vision used in traffic [1].

First, let's discuss image classification and object detection, specifically the difference between the two. The goal with image classification is to classify an object which the algorithm is presented with. Object detection is the same as image classification, but with multiple objects in one image and with the additional goal to localize these objects (Figure 2).

My goal was to be able to feed the object detection model an image containing LEGO bricks and get an output like in Figure 3. The blue boxes represent the ground truth, i.e. the actual bricks with their corresponding manually generated labels, and the white boxes represent the correctly guessed bricks by the model. A label for one of these bricks could for example be "Red 2x4".



In most models for object detection you divide the image into regions of $m \times n$ pixels, called anchor boxes, and then iterate over these regions while applying a classification algorithm. This way, when the classification algorithm classifies the object, your model also knows which region it is in (localization). One of the ways I leveraged this principle is modifying the Region Proposal Network (RPN) layer in the model, which, like the name suggests, is a network that proposes regions to loop over, in order to use smaller anchor boxes and therefore accommodate for the detection of smaller objects.

To evaluate and compare the performance of the model on the new dataset, and check if what I was tweaking actually had any effect on the results, I used the following metrics:

- Precision $P = \frac{TP}{TP+FP}$
- Recall $R = \frac{TP}{TP+FN}$
- F_1 score $= 2 * \frac{P*R}{P+R}$,

where True Positives (TP) stand for the number of bricks that were correctly recognized and localized, False Positives (FP) stand for the number of objects recognized or localized that weren't actually supposed to be recognized or localized and False Negatives (FN) standing for the number of bricks that should have been recognized and localized but weren't by the model. The precision score then tells us how the model performed relative to how many objects it detected in total (decreases if FP increases) and recall indicates how the model performed relative to the total amount of object it should have recognized. The F1 score is the harmonic mean of the first two metrics.

We also agreed with the peer group to consider multiple types of data. We had the real data consisting of manually taken, imported and labeled images of LEGO bricks. This dataset was the most accurate of course, but extremely costly to create considering the time it took and the money it takes when outsourced. That is why we came up with two other options: creating a synthetic dataset which consisted of 3D renders of LEGO bricks and a cutpaste dataset, where random bricks were photoshopped onto a background. This way we could check if the more efficient methods yielded similar results as the costly but accurate method, to help make a better cost-accuracy trade-off. Doing this also helped my dataset to be a lot larger in total, which is always better when training machine learning models.

Interestingly enough, the real dataset ended up being the worst performing set, with an F1 score of 80.64%, and the average of all of the datasets being an F1 score of around 90%. Since my datasets were quite small I think the model was very prone to overfitting on the data. If I were to hand pick a selection of images to test on which don't compare to anything the model has seen during training, the performance probably would have been a lot worse. For reference, many datasets I found online contained tens to hundreds of thousands of samples, whereas my dataset only

like cropping images showed a significant increase in the F1 score. That is a big lesson I learned when my supervisor told me "If you can barely recognize the image, how do you expect your model to recognize it?". I also found that using appropriately sized anchor boxes resulted in a significant increase in the F1 score of 15.9%.

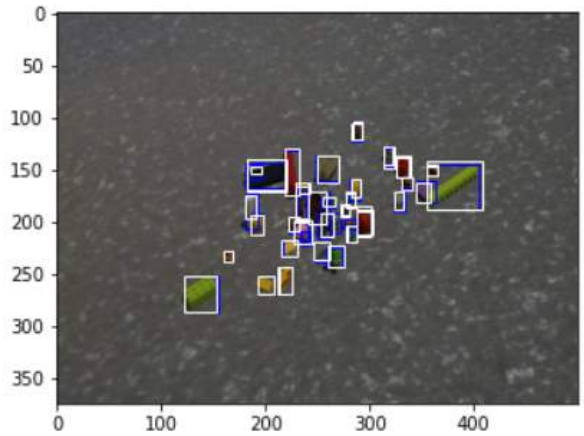


Figure 3: An example output for object detection applied on LEGO bricks would consist of this image and the printed corresponding labels [3].

Prior to this project I had never really worked with computer vision or machine learning models, so this was a very steep learning curve for me. I loved the autonomy and more academic approach to computer science, but that also meant I had to figure everything out on my own in ten weeks. In those ten weeks I took pictures and rendered 3D models for the custom dataset, labeled these images, watched endless PyTorch tutorials and did several iterations of coding and testing my hypotheses. I also watched a lot of Google machine learning tutorials to understand the underlying math and theory of what I was doing. Overall, I really enjoyed this work style and the autonomy and individual responsibility that came with it. I am naturally very curious and I loved exploring and testing different hypotheses and drawing conclusions from my results. No results are bad results! Showing that something doesn't work is as valuable as showing that something works.

The format of the research project is somewhat different depending on the supervisor: some supervisors give a very general topic and let you come up with your own research question whereas others give an example research question that you can then tweak or follow. The main thing about the research project is that it is very free. You can apply your creativity however you want and almost everything is negotiable with your supervisors. It is a refreshing environment compared to previous projects in the computer science curriculum, which are usually a bit more rigid and specific in what they expect from you.

During the project I found it important to maintain the integrity and value of my research. Reproducibility in machine learning is often a big issue and research loses its value when its results are irreproducible. My supervisor Jan van Gemert was especially strict on this and wanted the experimental design and execution to be described in great detail as well as every choice to be justified in order to avoid this problem as much as possible. The idea is that if someone reads your paper, downloads your dataset and runs your code they should get the exact same results that you described in your paper.

I did find that being so invested in your own research, and specifically the success of your research during your thesis, can be quite stressful. For example, I came to a point in week six of the project where none of my code and experiments were working, and my plan was to finish the project by week nine. It was especially stressful when comparing myself to my peers who seemed to be doing a lot better than me. I came to a point of just writing down every little thing that wasn't working for me and fixing everything on the list one by one. I think many students, and especially researchers, can relate to this feeling of overworking yourself, when you're so personally invested in the outcome of your work. I would like to advise anyone going into the research project to take frequent breaks and try to keep a positive mindset!

Another challenge I faced, like many other students, was that the whole project started and ended while the university was closed due to COVID-19. Luckily, this is an individual project, so logistically it worked out. It wasn't too hard to work and have online meetings with my supervisors, but I found that doing an individual project was even more lonely and hard during these times, because it can help so much to have people around you that somewhat understand what you're doing and that you can brainstorm with or share ideas with. I found a lot of support in my peer group, which consisted of four other students that were writing their theses on the same topic (but with different research questions) and scheduling meetings, working together over Zoom or even having lunch and an online chat really helped lift my spirits and stay motivated throughout the project. I hope that all the students out there are also taking care of themselves and are reaching out for support, because I know that studying can be hard during these times.

If you're interested in reading through my final paper to see what is expected during a computer science bachelor thesis, or just because it seems interesting, you can find it in the TU Delft repository [3] and to all future research project-ers, I hope you look forward to writing your thesis. I think it's a wonderful way of exercising what you've learned and challenging yourself one last time. For me it was especially worth it: I got an 8.5 and a free LEGO box set to keep!

References

[1] anonymous (2017). *Machine Learning Technique For Objects Detection*. https://www.cvdeveloper.com/projects

[2] Hulstaert, L. (2018). *A Beginner's Guide to Object Detection*. https://www.datacamp.com/community/tutorials/object-detection-guide.

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Working at Witteveen+Bos

Author: Ruud Tuitert, Employee at Witteveen+Bos

Witteveen+Bos is an engineering and advice agency, providing solutions to complex technical and ocietal issues regarding water, infrastructure, natural and build environment. Witteveen+Bos is all about bringing together the right knowledge to solve these issues. It is built on a network of 21 offices in 11 countries, where 1.100 engineers work together on creating a better environment for everyone, now and in the future.

When you read this company profile, it probably isn't the first company that comes to mind for a job in information technology. At least that's how I felt when I decided to leave my previous employer, a true IT company, and search for a new challenge. After a little bit of research on the company and a nice job interview I started as an IT advisor at Witteveen+Bos.

Digital Transition

Witteveen+Bos has a lot of ambition when it comes to IT. At this moment, Witteveen+Bos is in a digital transition. An organizational change in which the analog services are being expanded with new digital products and services, including new business models. Where a lot of companies choose to outsource IT, Witteveen+Bos is making the transition itself, by developing their own software and making the entire organization more IT savvy. IT is considered as an integral part of engineering, and to realize the right solutions software engineers need to work closely with domain experts.

"This is both a huge opportunity and challenge for IT specialists."

This is both a huge opportunity and challenge for IT specialists. For example, how do you manage all data available in the different domains? Especially with the latest's IoT developments, enormous amounts of data are available, such as data to monitor ship movements which is used to optimize harbor occupation. Or data about wave heights, used to prevent damage to underwater gas pipes in the Atlantic ocean. And perhaps it would be nice to combine these data sources to gain new insights, or provide new services. Within the digital transition I'm part of the digital tech team. This is a group of forerunners on the digital front, which helps the organization in its transformation. One of the initiatives originated in this team is the development of a digital product portfolio. This portfolio gives the organization insight in all digital products and services currently available or in development. A first assessment resulted in more than 100 initiatives already available within our organization. This varies from simple scripts to automate repetitive tasks to complex and innovative products, such as the Smart Engineering Information Management System (SEIMS). SEIMS is a product which makes it possible to generate a dynamic data model on which an information system can be generated. During the use of the system the data model can be updated based on new insights. SEIMS is currently being used by customers in the chemical industry to manage their assets. We hope the product portfolio will make SEIMS more visible within the organization, and hopefully expands the market for this product.

The assessment helps us not only with the market expansion of current products, it also gives insight in new product opportunities (for example, a script for automating tasks might also be interesting for customers) or new innovations by combining products and thereby offering new services.

Digital Technologies

Besides the tasks for the organization wide transition my work is organized within the product-market combination (PMC) Digital Technologies. PMC's are small organizational units ranging from 20 to 50 employees. Digital Technologies works on IT solutions for an involved society and improved living environment. Within this PMC I'm part of a development team with front-end developers, back-end developers and geographic information system (GIS) specialists. Examples of some web applications made by our team are A58inbeeld.nl and samenwaterproof.com.

Within the team my responsibilities are the planning and coordination of the software development and the gathering of requirements from our customers. These customers can be both internally and externally. Examples of external customers are Rijkswaterstaat (responsible for the

Witteveen + Bos

maintenance of the main infrastructure facilities in the Netherlands), Tennet (the Dutch electricity transmission system operator) and the Port of Amsterdam. Because our projects are often part of a larger project Witteveen+Bos is doing for these customers, we have a real impact on the efficiency and effectiveness both internal and external. For example, the online participation platform A58inBeeld.nl offers an easy and cost efficient way to reach a much larger audience that the traditional offline residential meetings organized to receive feedback on plans within the public environment.

The concept for a digital participation platform turned out to be very successful in project. Therefore we decided to offer a this platform as an online product, available for both consumers and business users. We called it the inBeeld. app ('InThePicture.app'). In a project oriented organization this turned out to be quite a challenge, although we lear

ned a lot and it is very valuable for the development of future products. One of the main challenges was the adoption of a new business model within the organization. Where the entire organization was designed for billable hours, we now had to think about product pricing. Also we first needed to invest a lot of money in the development of the product, for which the returns were still uncertain. We also needed to think about marketing (as we now have a standalone product) and a helpdesk. All these pioneering challenges we faced for this product pave the path for the digital transition and development of future products.

Wednesday Hackday

Another initiative from our team to help the digital transition is our 'Woensdag gehacktdag' (Wednesday Hackday), On this innovation day our team helps colleagues in the organization to realize their ideas for new digital products. An example of a product we've realized is a tool which assesses the lakes in the Netherlands for their suitability for solar panels. The gehacktdag is not only helping the digital transition, it's also an opportunity for our team to try out new technologies and frameworks. And by working together with other disciplines such as ecology, hydrology and architecture we learn a lot about those fields too.

To keep our own knowledge up to date, colleagues organize tech catchups. During these sessions we share knowledge about actual topics such as DevOps and the use of open data and choosing the right technology for each project.

"This dynamic environment offers a lot of freedom to suggest and implement new ideas."

All together this dynamic environment offers a lot of freedom to suggest and implement new ideas. And there is a lot to learn, both in the field of information technology, but also the other engineering disciplines.

Interested?

If you'd like more information about working at Witteveen+Bos, you can contact Ruud at ruud.tuitert@witteveenbos.com or check out the website at http://witteveenbos. com, which also lists the available internships and graduation assignments.

Studying at TU Delft During a Pandemic

Author: Isa Rethans, Computer Science student and Julian van Dijk, MSc student Computer Science

Last issue, some teachers told about their experiences adjusting to teaching from home. This issue, some students will tell about their experiences.

Changing environment - Isa Rethans

Hi I am Isa and I am in the third year of my bachelor computer science. Since March most educational activities have become online due to the coronavirus. This has had a big impact on the way of studying for all students. I will be telling something about my experience with online studying.

Personally, I have always been a fan of watching recorded lectures and just study from the book and all the other materials that each course provides. I find myself to be more efficient that way so I do not really find it a problem that the lectures are online now. What I find harder is the new way of having lab sessions and group meetings. Especially at the beginning I had to get used to the video meetings and communication via online channels. Simple things like when to start talking suddenly became a bit more difficult, but as time passed things like that become normal.

What I miss most is the social interaction of studying somewhere with friends and fellow students. I do not like spending so much more time in my own house, especially in my room where I both sleep and study. What helps me to make it better is to take somewhat bigger breaks than I would when I didn't study at home. As a break I like to go outside for some groceries, get a coffee in the city centre, do a workout or play a game with my roommates. I always do at least one activity outside, because I noticed that otherwise there were entire days that I would stay inside.

Now that the universities are partly open and there is a little more freedom to meet with others and go somewhere else, I try to regularly change environment. I alternate between studying in my room, at my parents, at my friend's house and sometimes I treat myself with a day of studying in a café with delicious coffee and food (not too often because it is expensive haha). In this way, I try to keep studying fun and stay motivated.

Although I prefer the situation before the pandemic very much, I try to make the best of it!

Adjusting to change - Julian van Dijk

Last academic year was my last year as a bachelor student. For some this meant the end of their study career, but for me and many others it was the start of my career as a master student. It felt significantly harder to pass those last courses of my bachelor. You have to find leftover discipline to learn for that last exam, but that was only partly the reason as to why it was hard. The currently still ongoing circumstances didn't help either. Exams were moved and study times were extended. This transformed that once so close holiday to an exam period, which no one I spoke to was happy about.

But that happened and now we are in a new year with new changes. So, how does it feel to study with the current COVID-19 measures? Honestly, it feels weird. Lectures are pre-recorded, streamed or turned into a Q&A session while we gloss over the slides. It's hard to pay attention to your lectures from home. You often just sit in front of a screen hearing someone talk about a difficult subject. This continues for hours every day. It does not feel like the studying that I used to do. During my bachelors I found friends, I went to all kinds of social events and I did extracurricular activities. These things still exist, but in an online setting, which is just not the same. The TU Delft is doing its best to ensure good education during these times, which is going pretty well all things considered, but I hope that we will find a way to improve the social side of online education this year.

The social side is probably more important for the students who came here this year than for students like me who already lived in Delft for the last three to four years. They are starting their lives in Delft during COVID, which makes it harder for them to meet people and make friends. I think it's important to keep that thought in mind for the students who have been here for multiple years already. I would recommend going to the mentorate and try to plan some fun online activities. Just talking and meeting new people makes studying during these times much more enjoyable.

Mathematics

The Game of Thievery

Author: Tom Heijnders, MSc Student Applied Mathematics

During my bachelor thesis I analysed the behavior of a thief who wants to break into houses. The motive for the thesis was the game of thievery. We will discuss this game and give the solution in this article. The solution of this game raised several questions which I examined in my thesis. To answer these questions I extensively discussed stopping problems in my thesis. With this knowledge I answered the remaining questions.

My thesis describes problems and theory from the field of *game theory*. The game of thievery and the remaining questions were introduced to me by my supervisor Robbert Fokkink.

A game of thievery

A thief can choose to rob 5 houses. House A, B, C, D, E with value 1000, 500, 400, 300 and 50, respectively. The thief chooses one house to rob and his profit will be the value of the house. However, there is also a police officer who guards a house. When the thief chooses this house, his profit is equal to 0. Both the police officer and thief are looking for their optimal strategy.

This is an example of a zero-sum game and we can solve this game using definitions and theorems from game theory. The set of strategies for the thief is given by $X = \{A, B, C, D, E\}$ and for the officer by $Y = \{A, B, C, D, E\}$. We say that A is the pay-off and if the thief chooses strategy $x \in X$ and the officer $y \in Y$ then the profit of the thief is equal to the loss of the agent and is equal to $A(x, y)$. We can write the function $A(x, y)$ in a game matrix and we get:

	A	B	C	D	E
A	0	1000	1000	1000	1000
B	500	0	500	500	500
C	400	400	0	400	400
D	300	300	300	0	300
E	50	50	50	50	0

. (1)

We can solve the problem using this matrix. Both the thief and officer can choose a mixed strategy. This is a probability of their strategy set. Using dominating rows and columns we can already delete some columns and rows from the matrix. The thief could rob house A with a probability of $\frac{1}{3}$ and rob house B with a probability of $\frac{2}{3}$. His expected profit is then equal or higher than 333,33 for all the strategies of the officer. From this we can see that it is never efficient for the thief to rob house D or E. And because the thief won't rob these houses, the police officer won't guard them. We now have the reduced matrix:

	A	B	C
A	0	1000	1000
B	500	0	500
C	400	400	0

. (2)

We can now use the theorem of indifference to determine the optimal strategies of the thief. According to indifference the value of the game must be equal to the expected profit of the thief independent of the choices of the officer. Take $\mathbf{p} = (p_1, p_2, p_3)$ the strategies of the thief with p_1 the probability of robbing house A, p_2 the probability of robbing house B and p_3 the probability of robbing house C. The same holds for the strategies of the police officer with $\mathbf{q} = (q_1, q_2, q_3)$. Take V the value of the game. From Indifference we get that:

$$V = \frac{4000}{11} \tag{3}$$

$$\mathbf{p} = \left(\frac{2}{11}, \frac{4}{11}, \frac{5}{11}\right) \tag{4}$$

$$\mathbf{q} = \left(\frac{7}{11}, \frac{3}{11}, \frac{1}{11}\right). \tag{5}$$

We can see that the thief with the highest probability chooses houses of low value and the officer guards houses with the highest probability of higher value. We will now take a look at the general case.

Take houses $1, 2, \ldots, n$ with value respectively $u_1, u_2, \ldots u_n$ such that $u_1 \geq u_2 \geq u_3 \geq \ldots \geq n$. The thief wants to rob a house and the police officer wants to guard a house. The game matrix looks like this:

$$\begin{pmatrix} 0 & u_1 & u_1 & \ldots & u_1 \\ u_2 & 0 & u_2 & \ldots & u_2 \\ u_3 & u_3 & 0 & \ldots & u_3 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ u_n & u_n & u_n & \ldots & 0 \end{pmatrix}. \tag{6}$$

We take $k \leq n$, the houses where the thief can rob the most. As in the game of thievery, the thief will only break into these k houses and the officer will only guard these. Take V_k the value of the game when choosing from just these k houses. The police officer has strategy $q = \{q_1, q_2 \ldots q_k, 0, \ldots, 0\}$. The thief has strategy $p = \{p_1, p_2, \ldots p_k, 0, \ldots, 0\}$. From indifference we get the following results for the optimal strategy of the thief and police officer:

$$p_j = \frac{1/u_j}{\sum_{i=1}^{k} 1/u_i} \text{ for all } j \leq k. \tag{7}$$

$$q_i = 1 - \frac{V_k}{u_i} \text{ for all } i \leq k \tag{8}$$

$$V_k = \frac{k-1}{\sum_{i=1}^{k} 1/u_i} \tag{9}$$

From the results we see that p_i decreases as u_i increases. In other words, the thief will be more likely to steal houses with less value. Against this we see that q_i increases as u_i increases. In other

words, the officer will be more likely to guard the house with higher value. This is interesting to see. Does a thief in reality break into poor neighborhoods more often? And does the police mainly guard rich neighborhoods?
In this case, the thief can only rob one house and there is only one police officer guarding the house. In reality, of course, there are several police officers who are spread out over different neighborhoods. The thief can also rob more houses, in this case the game starts to look like a stopping problem.
In my thesis I extensively researched stopping problems with their stopping rules. I looked at several examples to understand the material. This was very interesting to look into but unfortunately it could only help a little bit with answering the questions above.

For the case where the thief can choose more houses to rob, we distinguish two cases. The case where the houses have equal value and where the houses have different values. In the case where the houses have equal value we looked at n houses where the thief would steel m houses. There where a agents and their optimal strategy was now trivial. Because the houses had equal value the strategy of the agent is to guard a house with probability $\frac{1}{n}$. Using the theory of stopping problems we determined an optimal stopping rule for the thief. The thief should stop when:

$$m > \frac{n-m-a}{n-m}(m+1). \tag{10}$$

In case of houses with different values we could build further on this stopping rule by looking at two different values: houses with value x and houses with value y where $y > x$. We call these poor and rich houses respectively. We now take n the number of rich houses and k the number of poor houses. The agents will then divide among these houses. We call the number of agents who guard the rich houses a and the poor houses b. The total number of agents is then $a + b$ and is constant.
Take i the number of robbed poor houses and j the number of robbed rich houses. The current profit of the thief is now equal to $yj + xi$. Then the thief can decide whether he wants to rob a poor house, rob a rich house or stop. We take equation (10) and look at the individual cases. When the thief only robs rich houses, he has to stop when:

$$yj + xi > \frac{n-a-j}{n-j}(yj + xi + y). \tag{11}$$

If he only robs poor houses, he must stop when:

$$yj + xi > \frac{k-b-i}{k-i}(yj + xi + x). \tag{12}$$

Using these stopping rules one can think of many different strategies for the thief. In my thesis I have written a code where the thief could see all his options of robbing first rich houses and robbing first poor houses. He would then choose the strategy that gives him the largest profit.
The agents then wants to divide themselves such that the profit of the thief is as small as possible.
We take the number of houses equal to 1000 and the number of agents equal to 100. We let the number of rich houses n run from 1 to 999 with $k = 1000 - n$. For each $1 \leq n \leq 999$, the agents look at the profit of the thief for $1 \leq a \leq 99$ with $b = 100 - a$. In addition, we take $X = 1$ and $Y = 3$. The results are as follows:

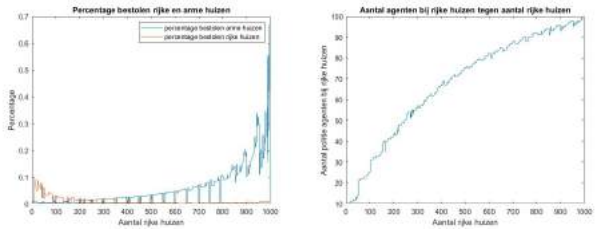

Figure 1: Graphs for optimal strategy agents and thief.

From the graphs we can conclude that also in this case the police wants to guard the rich houses and the thief prefers to steal from the poor houses.
Of course this is only in the general case when the police officers and the thief choose their optimal strategy. Because the many assumptions we took, it's not likely that this model can be used in real life. It is still interesting to see that in the game of thievery and in the case where the thief can rob more houses, the results are the same. The thesis is available on `https://repository.tudelft.nl/islandora/object/uuid%3Ac9139cd9-522f-47bf-b3bb-daad05d1362b?collection=education`.

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Response of an Electric Actuated Microbeam

Author: Jasper Rou, Msc Student Applied Mathematics

In this paper we discuss the response of a microbeam subject to an electric actuation. These microbeams are also called micro-electromechanical systems (MEMS). MEMS are used in many applications such as car airbags, the autopilot of an airplane, inject printers, pressure sensors, microphones in portable devices and the Nintendo Wii. Due to electric actuation the microbeam starts to oscillate. However, due to damping these oscillations fade out and the beam looses its applicability. By choosing the right frequency of our actuation, resonance occurs which prevents the oscillations from fading out. The aim of this research is to find out which oscillations these are.

Problem formulation

Consider a microbeam with a length l in the x-direction, width b in the y-direction and thickness h in the z-direction. A stationary electrode, completely overlapping the area of the microbeam is placed at a distance d in the z-direction. This electrode actuates the beam with a direct current (DC)-component V_p and an alternating current (AC)-component $v(t)$. The beam is subject to a viscous damping per unit length $\hat{c}$. Due to this actuation the beam will deflect. We let $w(x,t)$ denote the transverse deflection of the plate in the negative z-direction. We introduce the following symbols: ρ the density of the beam, E the beams Young's modulus, I its moment of inertia, ν the Poisson ratio, T the tension in the beam and ϵ_r the relative dielectric constant of the medium between the beam and the electrode. For certain frequencies of the AC-component, the beam may resonate. In order to use the microbeam we need to know how it moves.

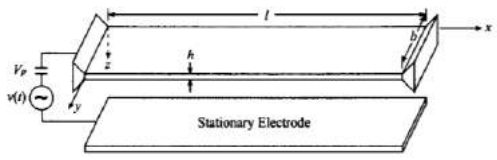

Figure 1: A schematic drawing of a simply supported microbeam.

We make a few assumptions about our microbeam. First, we assume that it is uniform along the width. Second, we assume that its length is much bigger than its width. These two assumptions result in the assumption that the deflection of the beam is uniform in the y-direction. Additionally, we assume the width is much bigger than the height, so that we can assume our beam is thin. Furthermore, we assume the height is much bigger than the deflection. This makes sure that the field lines of the electric field are perpendicular to the microbeam. This is a valid assumption since the beam collapses if the deflection becomes as large as the height. Since the microbeam is small, we assume its weight is small, this makes sure that we can neglect gravity. We also neglect the influence of transverse shear deformation and rotary inertia, this is called Euler-Bernoulli theory. Because the beam is thin, we can neglect the stress in the z-direction. Moreover, we can assume that the middle plane of the plate does not undergo in-plane deformation. We therefore say that we can approximate the movement of the three dimensional plate as a two dimensional plate by looking at the middle of the plate. This extension of Euler-Bernoulli theory, is called the Kirchoff approximation. With these approximations we can assume that the deflection in the x-direction and y-direction is small.

The equation of motion for this beam is:

$$\frac{EI}{1-\nu^2}\frac{\partial^4 w}{\partial x^4}+\rho A\frac{\partial^2 w}{\partial t^2}+\hat{c}\frac{\partial w}{\partial t}= \left[\frac{EA}{2l(1-\nu^2)}\int_0^l\left(\frac{\partial w}{\partial x}\right)^2 dx+T\right]\frac{\partial^2 w}{\partial x^2}+\frac{1}{2}\epsilon_0\epsilon_r b\frac{(V_p+v(t))^2}{(d-w)^2}.$$

If you followed a course on partial differential equations, you can recognize the equation for a one-dimensional string $\rho A\frac{\partial^2 w}{\partial t^2}=T\frac{\partial^2 w}{\partial x^2}$. The first term represents the internal forces, the third term the damping, the term with the integral the horizontal displacement and the last term the external force: the electric actuation.

For the boundary conditions we say that it is simply supported at $x=0$ and $x=l$. You can interpret this as the beam being attached to hinges. This gives:

$$\begin{cases} w(0,t)=0, \\ w(l.t)=0, \\ \frac{\partial^2 w}{\partial x^2}(0,t)=0, \\ \frac{\partial^2 w}{\partial x^2}(l,t)=0. \end{cases}$$

Solution to the problem

This differential equation cannot be solved exactly. To construct a solution, it is possible to use a computer to (very accurately) approximate the problem numerically. However, the disadvantage of this is that this does not give much insight in the physical meaning of the solution. This insight can be achieved by approximating the solution analytically. Moreover, having both an analytical and a numerical solution helps checking the correctness of the solution. One way to do this is using so called perturbation methods. The crucial step for perturbation methods is to find a parameter in your problem which is very small compared to the other parameters. Perturbation methods can be applied to many physical problems since they are capable of handling non-linear, inhomogeneous and multidimensional problems. Besides giving more physical insight into the solution, perturbation methods can be used to find more efficient numerical

algorithms as well. For the analysis of our problem, we will make use of a perturbation method called the method of multiple scales. The essence of this method is to introduce different time scales, which are assumed independent of each other.

The first step is to introduce a small, dimensionless parameter ϵ. This ϵ often appears naturally in our equation by comparing the sizes of the parameters. In our problem for instance $E = 10^{12}$Pa and $d = 10^{-6}$m. We can make all our parameters approximately the same order of magnitude by multiplying them with ϵ. The next step is to assume that the solution is of the form $w = w_1 + \epsilon w_2 + ...$ With this we can for instance make a Taylor expansion of the term $\frac{1}{(d-w)^2}$ as this non-linear term makes our equation impossible to solve. For our problem we can ignore all terms which are $O(\epsilon^4)$.

The third step is the most important. We introduce the two timescales $t_0 = t$ and $t_1 = \epsilon t$. Then $\frac{\partial w}{\partial t} = \frac{\partial w}{\partial t_0} + \epsilon \frac{\partial w}{\partial t_1}$ (chain rule from calculus/analysis). This seems to make the problem only harder. However, we see in the next step that it does not. We now namely split the equation in a part of $O(\epsilon)$ and a part of $O(\epsilon^2)$. The $O(\epsilon)$-part is:

$$\frac{\partial^4 w_1}{\partial x^4} + \frac{\partial^2 w_1}{\partial t_0^2} = N\frac{\partial^2 w_1}{\partial x^2} + V_0^2,$$

where we skip the boundary conditions for the moment. It is important to note that this equation does not depend on t_1. The solution to this is:

$$w_1(x, t_0, t_1) = \sum_{n=1}^{\infty} a_n(t_0, t_1)\phi_n(x),$$

with

$$a_n(t_0, t_1) = a_{n,0}(t_1)\sin(\sqrt{\lambda_n}t_0) + b_{n,0}(t_1)\cos(\sqrt{\lambda_n}t_0) + C_n.$$

We do not know yet the functions $a_{n,0}(t_1)$ and $b_{n,0}(t_1)$, these follow from the $O(\epsilon^2)$-problem:

$$\frac{\partial^4 w_2}{\partial x^4} + 2\frac{\partial^2 w_1}{\partial t_0 \partial t_1} + \frac{\partial w_2}{\partial t_0^2} + c\frac{\partial w_1}{\partial t_0} = N\frac{\partial w_2}{\partial x^2} + 2V_0^2 w_1 + 2V_0 A\sin(\Omega t_0).$$

The solution to this equation is way more complicated than the $O(\epsilon)$-problem. Luckily, we do not want to solve this. As long as w_2 is small, w_1 gives a good approximation for w. We can make sure that w_2 stays small because we can still choose $a_{n,0}(t_1)$ and $b_{n,0}(t_1)$, this is the big advantage of our two timescales. This solvability condition leads to differential equations for $a_{n,0}(t_1)$ and $b_{n,0}(t_1)$, which depends on the frequency of the current Ω.

I will present two cases here. In figure 2 the solution is presented if Ω is not close to any resonance frequency. In figure 3 the solution is presented if Ω is a resonance frequency. We can see that the deflection for the resonance frequency is indeed much larger than for the other frequencies which is what we would expect. We can actually make very cool animations of this where you see that for the first case the oscillations fade out and for the second case become larger and larger. We can compute the energy of the beam as well and see that in the first case the energy converges and in the second case continuous growing as we would expect. A third case worth considering but not done here due to lack of space is a frequency close to a resonance frequency and see if we can predict in which intervals the beam keeps its applicability.

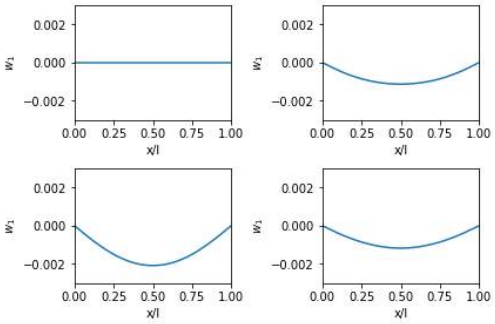

Figure 2: w_1 against $\frac{x}{l}$ at different times. Ω is not close to any resonance frequency.

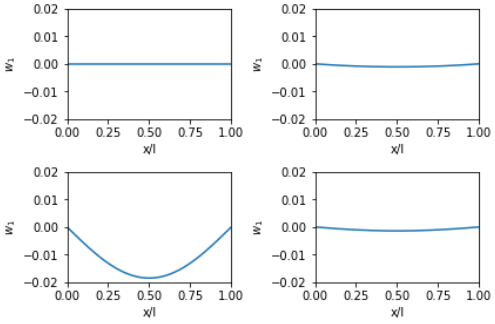

Figure 3: w_1 against $\frac{x}{l}$ at different times. Ω is equal to a resonance frequency.

Conclusions

In this paper we considered the response of a simply supported microbeam actuated by an electric actuation. In order to solve our equation of motion we used the method of multiple scales. With this method we have constructed a solution to motion of the microbeam which is valid up to times $O(\frac{1}{\epsilon})$, where ϵ is a small dimensionless parameter. We have looked at the behavior of the microbeam for different frequencies of the alternating current of the electric actuation: not close to the resonance frequencies of the system and exactly the same as one of the resonance frequencies of the system. For the frequency of the alternating current Ω far away from the resonance frequencies we found that due to the damping our solution remained small. For Ω equal to one of the resonance frequencies we have seen that resonance phenomena occur.

This research can serve as a first step towards other researches. One could for instance consider the damping one order smaller. The damping is often unknown but we hope it is small as it limits our beam. Furthermore, the equation can be extended to two dimensions for a plate with length and width equally large. This would actually not change the solution very much. Lastly, a different boundary such as clamped boundary conditions can be considered. If you are interested to learn more you can check out [1].

References

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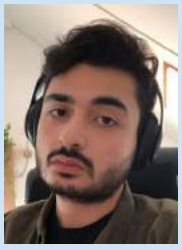
Studying at TU Delft During a Pandemic

Authors: Saqar Khaleefah, AM Bridiging Minor Student and Jarno Vegting, Mathematics Student

Last issue, some teachers told about their experiences adjusting to teaching from home. This issue, some students will tell about their experiences.

Missing the campus - Saqar Khaleefah



My name is Saqar and I am a third year Applied Physics student doing the bridging minor to the applied mathematics Master. In the past two years as a student at TU Delft I, like many others, have developed the habit to exclusively/mostly study in an on-campus facility, like Pulse. I separated my life studying on-campus with my private life at home to balance this out. In fact, I barely got any studying done at home unless it was a morning deadline. For most of my studies this separation worked perfectly, and I never worried about my lack of productivity at home.

Since the lockdown I struggle to find the concentration (and especially motivation) to replicate those long hours of studying at Pulse in my room. While I am grateful for the efforts of the teachers and TAs, I still miss the simplicity of verbal communication and engagement in an exercise class. I appreciate the resources they have managed to provide through online methods, although some courses are organized better than others. Nevertheless, I still despise the idea of maintaining this form of education any longer. The on-campus interaction between instructor and students is incomparable to the current alternative. Taking into consideration the amount of technical issues we run into, it comes as no surprise that efficiency has declined. I struggle with learning, especially when it comes to doing computer assignments. Sometimes you want to ask something that's more than just a Google search away (or a Microsoft teams message, nowadays). Personal interaction between instructor and students is essential, but the barrier of online education hinders that. Though I am reluctant to admit it, I have become a lazier student. My interests have diminished, I feel as if spending hours behind my laptop at home is slowly decaying my cognition. On-campus education is invaluable.

Ups and Downs - Jarno Vegting

Studying at home has had its ups and downs. A few things that helped me are:

1. Working together

It seemed that my friends and colleagues were more willing to work together on exercises by voice or in person.

Moreover, it was easier to match schedules, as there were fewer social activities and their results to navigate around.

Also, I am very thankful for the time saved on useless physical meetings.

2. Using the forums

It is efficient to ask questions on a forum whenever you are working on the exercises and get good answers that won't be asked twice.

This should be used more, also after the crisis ends.

3. To divide my space into zones for different activities

A nice YouTube video on this topic is "Lockdown Productivity: Spaceship You" from https://www.youtube.com/watch?v=snAhsXyO3Ck

4. Using my desk space more efficiently

I bought a monitor/laptop holder computer (approximately 50 euro on Amazon from https://amzn.to/2Sx6mIY).

5. Keeping the mental overhead from online communication as low as possible

I try to avoid using the webcam when I don't need to.

6. Keeping myself physically healthy and go outside

I recommend the TU Delft's friendly bootcamp "Spartan Workout" which is free with an X subscription and requires no physical contact or proximity (see: https://www.tudelft.nl/en/x/whats-on-offer/overview-a-z/spartan-workout/).

Extracurricular

Computer Science Puzzle

Author: Louise Leibbrandt, Editorial Staff MaCHazine

Palindrome Counting

In how many different ways can the palindrome

WAS IT A CAT I SAW

be read in the diamond-shaped arrangement shown in Figure 1? You may start at any W and go in any direction on each step—up, down, left, or right—through adjacent letters. The same letter can be used more than once in the same sequence.

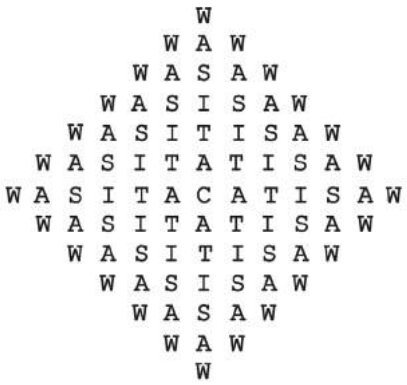


Figure 1: Letter arrangement for the Palindrome Counting puzzle.

Solution to last issue's computer science puzzle: Inverting a Coin Triangle

The minimum number of coin moves needed to invert a triangle with $T_n = n(n+1)/2$ coins is $\lfloor T_n/3 \rfloor$.

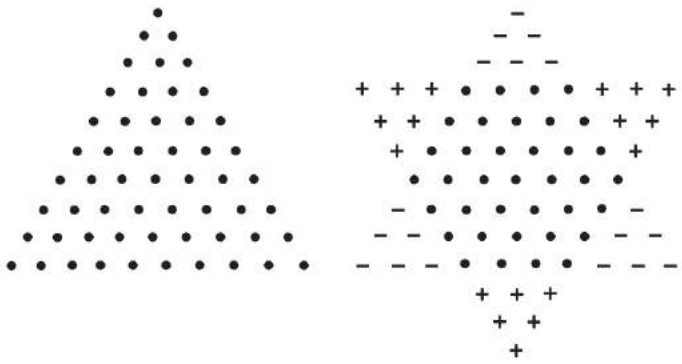


Figure 2: Inverting a triangle with T_10 coins by making row k = 4 the base of the inverted triangle (+, –, and small circles indicate centers of the added, moved, and stationary coins, respectively).

References

[1] Anany Levitin and Maria Levitin, *ALGORITHMIC PUZZLES*, p. 56, p. 183-184, 2011

Mathematics Puzzle

Author: Annerieke Ohm, Editorial Staff MaCHazine

Problem 1

Suppose that by law, a company has to give all of its employees a holiday whenever any of its employees has a birthday.

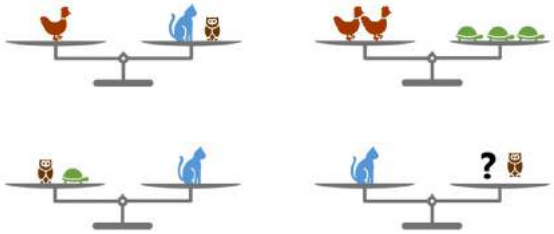
A company cannot discriminate based on a person's birthday.

The employees really enjoy the birthday holidays, so they work all other days of a 365 day year.

How many workers should the company hire so that it has the largest expected person-days worked per year?

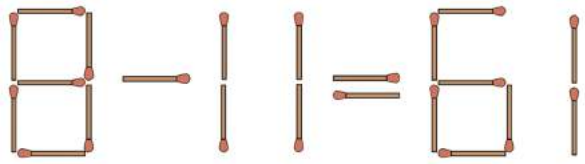
Problem 2

Suppose one chicken weighs the same as one cat and one owl. Next, suppose 2 chickens weigh the same as 3 turtles. Furthermore, suppose one owl and one turtle weigh the same as one cat. How many owls does one cat weigh?

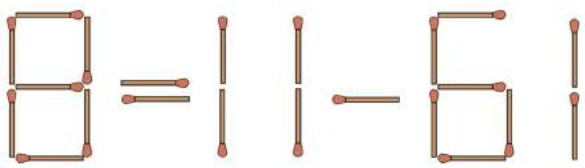


Solution to last issue's Problem 1

The first step is to move the stick at the bottom of the number 4, turning the 4 into an 11.



Next, take one stick away from the equals sign and use it to turn the minus sign into an equals sign.



Finally, turn the equation upside down to get a correct equation.

Solution to last issue's Problem 2

We can turn this into an equation. Placing a 1 in front of a five-digit number is the same as adding 100000 to the number. Placing a 1 at the end of a five-digit number is the same as multiplying the number by 10 and then adding 1. If x represents the five-digit number we're looking for, the equation becomes:

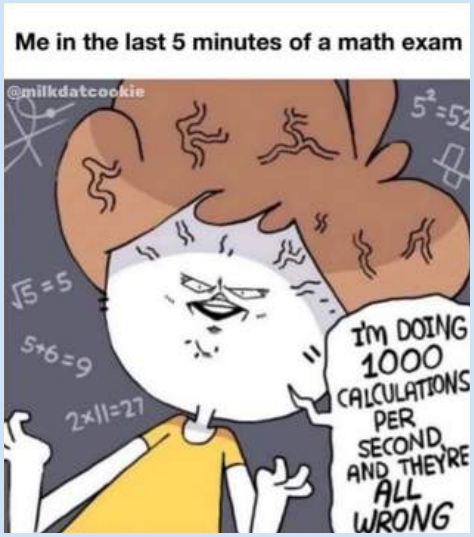
$$10x + 1 = 3(100000 + x) \quad (1)$$

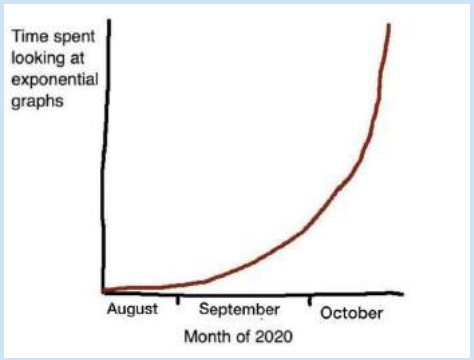
All that's left to solve this equation:

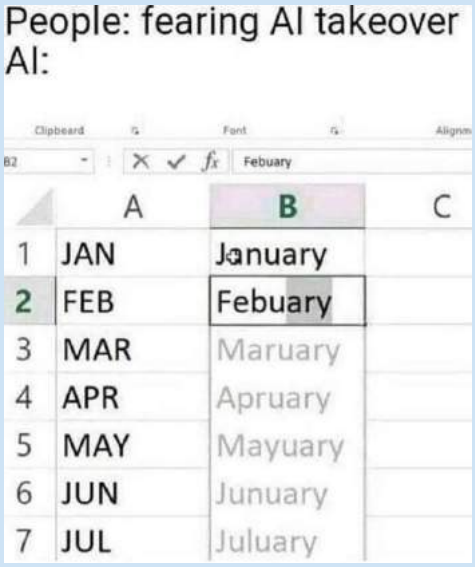
$$10x + 1 = 3(100000 + x) \quad (2)$$
$$10x + 1 = 300000 + 3x \quad (3)$$
$$7x = 299999 \quad (4)$$
$$x = 299999/7 \quad (5)$$
$$x = 42857 \quad (6)$$

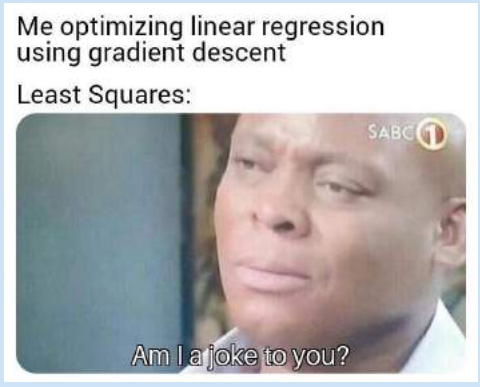
So the five-digit number we were looking for is 42857.

Memes









Want a meme featured in an upcoming issue? Send it to machazine@ch.tudelft.nl!

Symposium

On November 19th, the symposium "Advanced Analytics: Diving deep into your data" will be held. During this online event, we will explore the possibilities of the state-of-the-art data analytics techniques as well as discuss the ethical concerns associated with processing personal data. For more information, visit wisv.ch/symposium.

Programming Contest

Do you like solving algorithmic puzzles through programming? On November 14th, the Delft Algorithm Programming Contest (DAPC) will be held online, where you can compete in a team against like-minded people. This contest is interesting for mathematicians and computer scientists alike. For more information and example problems, go to wisv.ch/DAPC.

On-Stage Interview

On the 14th of December, the On-Stage Interview of Ronald Prins will take place. He will be interviewed by Joost Schellevis, a tech-journalist of the NOS. Ronald Prins is a TU Delft Applied Mathematics alumnus, co-founder of Fox-IT, an Associate member at the Dutch Safety Board and a member of the TiB. For more information, go to wisv.ch/OSI.

November

9	**Committee Kick-Off**
10	**Lunch Lecture: ASML**
14	**Delft Algorithm Programming Contest**
17	**Lunch Lecture: Shell**
18	**Double Degree Activity**
19	**Symposium – Advanced Analytics: Diving deep into your data**
24	**Lunch Lecture: Studying during the pandemic**
25	**Career College: Elevator Pitch**
26	**Board Interest Lunch**
30	**CH Movie Night: To Be Announced**

December

1	**Lunch Lecture: Education**
12	**Benelux Algorithm Programming Contest**
14	**On-Stage Interview: Ronald Prins**
15	**Lunch Lecture: Harvest**
16	**Christmas Activity**
17	**General Assembly 3**
19	***Start Christmas Break***

Want to stay updated on our events? Add the CH calendar to your own with our step-by-step guide on **wisv.ch/calendar.**

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