Video Reflections

Introduction to Computer Science I

This is the series of weekly exercises that connect programming homework to everyday life experience of the students, illustrate interdisciplinary applications of computing and technology, and highlight the new issues that computing technology brings.

Recommendations

Students are allowed to work solo or in pairs, and to use any resources available to them (internet sites and forums, classmates, family members, friends outside of class, etc.) No prior experience with computer science is necessary to complete the exercises, and no programming is involved.

Each exercise is given as a last problem in a weekly programming homework assignment that also contains three or four programming problems. In my class all homework problems are weighted equally, and the grade for the video reflections constitutes about 20% of total homework grade (which in turn constitutes 25% of the course grade), hence the total grade for all video reflections is roughly 5% of the course grade. About 90% of the students choose to complete video reflections. An interesting side effect is that many students start viewing other computing-focused videos, paying more attention to computing resources and news, and sharing those resources.

Often each exercise connects to programming assignments and in-class discussion of respective week, however, this connection should be made explicit by the instructor. The exercises in the sequence are self-contained and don't rely on particular topic coverage, they can be reordered and replaced. A conscious effort was made to include culture- and gender- diverse speakers, and to cover a broad variety of topics.

There is no one right answer to most questions. Coherent short-paragraph responses are expected (not just a list of bullet points). Student submissions are graded by undergraduate graders based on effort/completion. Instructor reviews select submissions. Some outstanding answers (both correct and incorrect) can serve as starters for in-class discussions.

• Algorithms around us, week 0

The last problem in most labs will be a non-coding assignment that will help you learn more about different branches of computer science, the problems that CS is solving and facing these days, technologies of the future, and so on. Unlike other problems in the lab, you're welcome to consult any source you find credible, including internet sites and forums, family members, friends outside of class, your class colleagues etc - of course it's optional and you may complete the answers on your own.

There is no one right answer to most of the questions. This week we'll think about how the algorithm underlie many facets of everyday life (in the US).

Watch TED talk by Kevin Slavin "How algorithms shape our world" (15 minutes):
http://www.ted.com/talks/kevin_slavin_how_algorithms_shape_our_world?language=en

Why do you think the algorithms can (or cannot) be viewed as part of nature, as the speaker claims in his last sentence? (Provide a 1-3 sentence response)

We are not algorithmic stock market traders, so how do algorithms shape our world? In other words, how is your day-to-day life governed or affected by the work of algorithms? For example, if you live in a dorm, your roommate was likely chosen by a matching algorithm that assigned roommates of the same sex to a room. When you ride a bus or use a pedestrian crossing, the traffic-light schedule has a complicated algorithm behind it that aims to optimize safety, minimize traffic jams in the city, and so on. Give at least three of your own examples (more the better, upper bound is 10).

For each of your examples, how would you know if the algorithm failed to work correctly, and how would you be able to detect that? (For instance, in roommate matching if ten people were assigned to the same 2-person room, we would know there was a problem. If green on the traffic light only lasted 0.1 seconds, we'd suspect a problem as well).

[Connects to discussion on ubiquity of computing and exercises on program testing]

• Unity in diversity, week 1

For your answer you're welcome to consult any source you find credible, including internet sites and forums, family members, friends outside of class, your class colleagues etc - of course it's optional and you may complete the answers on your own or with your partner. There is no one right answer.

Watch the talk by Computerphile "The Problem with Time and Timezones" (10 minutes): https://www.youtube.com/watch?v=-5wpm-gesOY

As you could see in the talk, and while working on your BMI program, the diversity of users of your product will affect the way you will have to design the product. Give example situations when differences (in age, sex, gender identity, disability status, national origin, geographical location, cultural identity, economic status, language spoken and other differences) among the users of software applications and hardware devices affect the way we should design these software applications and hardware devices. Give at least four example scenarios (max is 10) and explain how the differences affect the design in 2-3 sentences for each case.

[Connects to exercises on conditional execution and discussion of user diversity]

• Games for good, week 2

Watch the talk by Justin Tan "Using video games for better medical rehabilitation" (14 minutes): https://www.youtube.com/watch?v=5rsyr8oS_xs

As you can see from the talk, gaming hardware can easily be used for medical purpose. Initially computer games were developed as entertainment, but now have found "practical" uses in several unexpected areas. Using Internet search and your imagination, discover the cases in which computer game software and gaming hardware (such as Wii remote, Kinect), are used to achieve a goal other than entertainment. One notable example is the FoldIt project, but there are many more areas where computer games brought advances. You can talk about existing cases, or you can envision and predict potential applications of gaming technologies in other areas of life. In your answer, provide at least 3 examples (max is 7), with 2-4 sentence description for each case. For your answer you're welcome to consult any source you find credible, including internet sites and forums, family members, friends

outside of class, your class colleagues etc. - of course it's optional and you may complete the answers on your own or with your partner. There is no one right answer to this problem.

[Connects to an assignment on number game using loops]

• Computer history exhibit, week 3

In this assignment you will take a role of a museum curator. You will select a piece to represent a milestone in computer technology development. Together with the choices of your classmates, it will form our class virtual exhibit of computer history.

To start, watch a TED talk by John Graham-Cumming "The greatest machine that never was" (12 minutes)about the machine that was the first computer and about the first programmer.

https://www.ted.com/talks/john_graham_cumming_the_greatest_machine_that_never_was?language=en

Then take some time to visit the exhibits Computer History Museum
http://www.computerhistory.org/exhibits/

Select one piece for our virtual exhibit. It can be a computer program, a hardware device (e.g. the first mouse) or computing device, can be an idea or its realization, or phenomenon, or event. Essentially something that changed the path of computer technology development. It doesn't have to be in use today. For your answer, submit a link to your piece (an article or video about it), the year when the piece first appeared, and a 3-5 line description of why you believe this is a crucial piece for the exhibit, what was its role in computer history. This is not a knowledge-based assignment, you're not expected to know much computer history going into this class. You should spend time reading and researching before your provide the answer. Your link doesn't have to go to computerhistory.org, if you find an interesting video on YouTube or elsewhere (or maybe you'd like to make one?), you should include it instead. Remember to provide the specific detail that identifies your piece (don't just say "a mouse", mention maker, model and year for the mouse, and so on). (The examples used in the text of this assignment - Babbage engine and mouse - are already taken and cannot be used as an answer).

[Connects to the course module on computer organization]

• Codebreakers, week 4

The encoding/decoding system that you implemented in lab this week is one of the early encryption methods used by the humanity. It would be easy to decrypt the text produced by Caesar cypher - just try all possible 26 shift values on the input, and view the resulting text. Devising encryption methods that would be hard to decrypt, as well as breaking those methods is a difficult task. Some people argue that understanding how to break codes is as important as understanding how to make them. Watch the talk by security analyst, cyber punk, hacker pride, geek girl Keren Elazari "Hackers: the Internet's immune system" (16 minutes):
https://www.ted.com/talks/keren_elazari_hackers_the_internet_s_immune_system#t-861538– What's your opinion on the speaker's main argument? Do you agree that hackers are the Internet's immune system? Why or why not? Explain your point in 3-6 sentences.

– There are several examples in the talk of the situations in which hackers may have done "good", but their actions where illegal according to the current law. How do you think the law should treat hackers, breakers, cyber attackers? Explain your point in 3-6 sentences.

– In 3-6 sentences, summarize the possible positive and negative effects of a hacker's actions. Feel free to use infamous events such as Target data breach, Sony Pictures data leak, Ashley Madison hack, Experian data breach (search for these news on Google if necessary) as examples.

[Connects to the assignment on string encoding and decoding, Caesar cypher]

• Visualization, week 5

Representing the information visually has led to dramatic advancement of many fields. Watch the TED talk by Hans Rosling "The best stats you've ever seen" (17 minutes): http://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen

– Look at the list of undergraduate major programs at Tulane: http://admission.tulane.edu/academics/majors.php.

Select 4 professions (majors) in which the people are highly engaged in data analysis and are likely to benefit from data visualization tools such as gapminder.org presented by Prof. Rosling. For each of the 4 examples, name the area and explain how the data visualization tools can be beneficial.

– Find your own example story of how computer graphics or visualization help in everyday work of a non-CS professional. Submit a link to this story (can be video, podcast or online article) and a 2-3 sentence summary.

[Connects to the assignment on data analysis and histogram construction using Python dictionaries]

• Algorithm competition, week 6

Asymptotic analysis is one good way to compare algorithms, but, as you could see in the previous exercise, running the algorithms side by side on the same input adds to the understanding of relative algorithm performance. Using an internet search, find two concrete examples when performance of software programs or technical devices is being compared side-by-side with other programs/devices or with performance of humans (such as the annual robotic soccer competition http://www.robocup2015.org/ where different classes of robots are compared based on their ability to play soccer). Your response can refer to a story or news item or video or established competition.

– Submit links to both of your examples.

– Provide a 2-3 sentence description of the essence of the competition.

– Explain how the winner is decided, what is the success criterion (speed? accuracy?)

– For your two examples, can you imagine a way to combine technology from these two examples to make an even more powerful technology? (For instance, if one competition is between soccer-playing robots and one between voice recognition software, then installing voice recognition software on those robots could help robots from the same team communicate during the game with sound commands,

thus improving their play). If yes, describe this imaginary combination. If not, explain how either of these technologies can help humans achieve their routine tasks more efficiently.

[Connects to the assignment on comparing performance of sorting algorithms]

• Cybersecurity, week 7

In the past weeks you explored applications of computing in different fields of study. In the next few weeks you'll be looking at the impact computing technology is making on societies and humanity in general. In the spirit of upcoming Halloween we'll start with the scary topic.

Watch the TED talk by James Lyne "Everyday cybercrime - and what you can do about it" (17 minutes): http://www.ted.com/talks/james_lyne_everyday_cybercrime_and_what_you_can_do_about_it

 – One of the types of crime that computing technology made extremely easy to achieve is identity and personal data theft. In your opinion, why is identity theft is a problem? How can identifying information be misused? What about other types of personal data? (Think about 2-3 different areas of one's life, e.g. what if your grade information is stolen? What about your health records? Or purchase history?) Explain your point in 3-6 sentences.

 – In the talk, the speaker mentions several ways of making oneself vulnerable by exposing too much data. For instance, posting photos taken at home publicly allows the entire world to see your home address (gps coordinates) if geotagging is not turned off. Which of these steps are true about you (and which are not)? After watching this talk, do you believe it is possible to completely avoid exposing personal data? Why or why not? Provide a 3-6 sentence answer.

[Connects to the discussion of computationally hard problems and role of prime numbers in encryption of internet transactions]

• Internet for greater good, week 8

This week we continue exploration of the impact computing technology is making on societies and humanity in general, and turn our attention to positive sides of this impact.

Watch the TED talk by Luis von Ahn "Massive-scale online collaboration" (17 minutes): https://www.ted.com/talks/luis_von_ahn_massive_scale_online_collaboration

Then answer these questions:

– How does Duolingo deal with the fact that people who translate the texts are not professional translators and are beginning learners? How can this approach be applied in other areas of life (provide an example).

– What other good products or ideas came out of online collaboration of volunteers over the Internet? Search the web and talk to your circle of friends to generate at least two example products, websites, or technologies. Have you taken part in any such initiative? If yes, please share your experience.

– In your opinion, what are other advantages and advances that personal computers and connecting them via the Internet has brought to the humanity? Give at least three 1-2 sentence examples. (Try to focus on implications. It's clear that computers help us crunch the numbers faster than we would have

done manually, but what implication does this have on the everyday life of a person, society, or humanity in general?)

[Connects to discussion of role of computing in society and tasks suitable for computers]

• 3D printing, week 9

This week we continue exploration of the impact computing is making on societies and humanity in general. Many of advances are brought by technological inventions. One such invention which may soon bring dramatic changes in our day-to-day life is 3D printing technology. Watch Lisa Harouni "A primer on 3D printing" (14 minutes): https://www.ted.com/talks/lisa_harouni_a_primer_on_3d_printing

 Then answer these questions:

 – How would your day-to-day life change if you had access to an affordable 3D printer and raw materials? What would you print? Provide 2-3 sample objects or scenarios, and explain the advantages of using 3D printing vs. the ways you obtain these products now.

– If (when) 3D printing becomes as common as high-speed internet or washing machines, how would the world be different? For instance, if you can print a plastic cup, it won't be necessary to export it from abroad, and the world trade and manufacture will be affected. Think of specific examples of people's ability to print things on demand which will alter the way we approach things today.

– What computer science problems appear in 3D printing? Formulate at least 2 example problems, ideally a few more. If necessary, refer to Wikipedia article on "Computer Science" to see the list of CS areas, and think about which of them may be involved in 3D printing.

– What problems/topics that we encountered and studied in this class could potentially appear in a 3D printing context? Formulate at least 2 specific example problems, ideally a few more.

– This is an optional part. If you've been impressed with what 3D printing can do, here's another fascinating talk about its abilities https://www.ted.com/talks/anthony_atala_printing_a_human_kidney

[Links to the discussion of connections between different areas of CS]