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CMP UG Challenge 2020

Improve your design and programming skills and add a project to your CV by completing one of the CMP UG Challenges!

We have put together five challenges. Read them carefully and select ONE that you would like to take on. All challenges can be attempted individually or as a team. Each individual/team member must be a current UEA CMP undergraduate student. There is no limit on how many team members a team can have. The only rule is that each member MUST have their own distinctive contribution to the solution. Your solution can be a novel idea presented as a storyboard or similar format, and/or a qualitative prototype using any programming language on any platform. The submissions will be judged based on novelty, innovation, and potential impact. Once you have decided which challenge to take and whether to take this challenge as individual or a team, you will need to register through an online form (see "Are you Ready" section). The start date is **18 May 2020** and the deadline for solution submission is **15 June 2020**. There will be prizes for the best submissions. Results will be released at the end of July, and winners will be showcased in the school TV screens.

Challenges:

1. Contact tracing

   The scenario:
   Alice works in a care home; she is infected with COVID-19 but has had no symptoms, so is working normally. She develops symptoms and reports that she's self-isolating at home. In order to stop the spread of the virus it's important to trace everybody she's been in contact with – for these purposes that's everybody she's been less than 2 metres from for 15 seconds or longer over the previous 10 days.

   Things to think about:
   - Bluetooth or similar for proximity?
   - GPS for route/activity tracing?
   - How to ensure privacy preservation?
   - What are the data storage, transmission, retention, requirements?
   - What's the minimum data that's needed outside the phone?
   - How secure is data in the phone? (What is "sufficiently secure"?)

2. Reaching isolated people

   The scenario:
   Many vulnerable people, particularly in rural areas, are finding it difficult to have food and other essentials delivered (e.g. from food banks or pharmacies). This challenge is about linking deliveries to journeys that are already being made – similar to community ride sharing schemes or freight and vehicle exchange services such as returnLoads.net (https://www.returnloads.net/green/).

   Things to think about:
   - How to keep the data current?
   - What's the update frequency?
   - How to restrict offers and requests to suitable times and places?
   - How to stop scams?

3. Key worker movements and biosecurity

   The scenario:
   In farms and food processing it's important to know that the workers are not spreading infection, whether to co-workers, animals or plants – it's a wider issue than coronavirus containment. We are in a situation where everybody working in the agriculture and food industry, many of whom move frequently between work locations, needs to be able to show where they've been and where they're going to. This requires each person in the food handling chain to have a unique traceable identifier, with their recent employment history and details of their current qualifications and certifications. The Agriculture and Horticulture Development Board and others are producing paper forms, which are complex, have to viewed by hand (i.e. not through a window etc.) and which can be downloaded with no checks – so how long before everyone has one!

   Things to think about:
   - QR codes are attractive but are they sufficient as credentials for this application?
   - How secure does the audit trail have to be? Blockchain?
   - What's feasible on a low-end smartphone or tablet?
   - can we integrate the existing data sources?
   - How do we establish and verify trust in the credentials?

4. Social life, welfare, and awareness

   The scenario:
   With COVID-19 taking a grip all over the world, the outbreak has forced the cancellation of trips, nights out, and large gatherings. The entire world is now working remotely, and everyone is asked to stay at home. Jo usually does her weekly grocery at her local supermarket and finds it particularly challenging to shop over the Internet

due to surging demand. In addition, Jo sometimes does not know exactly what she wants to buy, and finds products sorted by categories unhelpful. Can you help improve Jo's online grocery experience a little better?

Things to think about:

- How to innovate online shopping experience while simultaneously meeting high demand
- How to preserve users' privacy while shopping online
- How to enforce cyber security for users shopping online
- How to efficiently manage supply chains
- How to manage large increases (spikes) of server load/requests

5. Algorithmic challenge

The scenario:
Given an input sequence obtained by a permutation of 1, 2, . . . , n , write a program to determine the minimum number of values to erase from the input sequence to obtain an increasing sequence.

For example: if the permutation is 3, 1, 2, 6, 4, 5 , the program should return 2, as erasing 3 and 6 produces 1, 2, 4, 5.

How would you generalise your program to process any sequence of numbers (i.e. not necessarily a permutation of 1...n)?

Things to think about:

- Which programming language to use (suggest Python, Java or JavaScript)
- Consider the following input sequence (test data) in your program:
    - 11, 5, 9, 7, 1, 2, 8, 3, 4, 10, 6
    - 15, 13, 7, 11, 9, 16, 12, 2, 8, 5, 17, 1, 3, 14, 4, 6, 10
    - 8, 9, 2, 6, 4, 5, 3, 1, 10, 7
    - 8, 9, 13, 5, 6, 16, 17, 14, 7, 15, 12, 10, 4, 11, 20, 1, 3, 18, 19, 2
- For each input sequence above, you would produce an output with the following headings:
    - Input sequence =
    - eliminated count =
    - increasing subsequence achieved =
    - processing time in seconds =
- The program should be able to process inputs of 1000 elements in seconds.

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Support

Support can be provided using online project management platform "Trello" https://trello.com. Open an account with Trello if you have not already done so. Create a board and name it "<your name> OR <your group name> CMP UG challenge 2020". For team-based projects only ONE Trello system is needed. Invite the following people to your Trello project:

- Jeannette Chin – j.chin@uea.ac.uk
- Debbie Taylor – Debbie.Taylor@uea.ac.uk
- Eleanor Leist - E.Leist@uea.ac.uk

Submission information

Source code: Code must be submitted to GitHub repository.

- Step1: sign up github : https://github.com/
- Step2: create a project repository
- Step3: upload your code
- Step4: add Jeannette Chin chin.jeannette@gmail.com to your project repository as a collaborator

GitHub guide: https://guides.github.com/activities/hello-world/

Demo video: Upload a video showcasing your solution to YouTube https://www.youtube.com (as an unlisted video).

Submit before deadline (15 June 2020) –

1. Send an email to j.chin@uea.ac.uk and cc to Debbie.Taylor@uea.ac.uk
2. The email subject title should be: "CMP UG Challenge 2020 <team> OR <individual>"
3. The email should include the following THREE items:
    a. One page word file with a description of your project with the following sections:
        i. Project Title;
        ii. Name(s) (all who involved) and their contributions;
        iii. Summary of your project;
        iv. Key highlights/novel ideas of your project to solve your selected challenge.
    b. A link to your GitHub project; and,
    c. A link your video

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Are you ready?

Let's go! Registration is now open:

https://tinyurl.com/y8cxp6ve

Very best of luck!

CMP UG Challenge 2020 Organising Team

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