ELEC230 Assignment 2 – Part 3 questions

(Part 3 is worth 20% of the assignment grade)

For most questions below you can find the tools you need to answer them in the relevant lecture material on Canvas, or in the main recommended e-book for sensors (**click here**). Occasionally, you may need to think a bit more deeply or do some brief independent research more widely than Canvas or the textbook; if so, please provide references for your sources of information.

Please explain each answer for questions 1 to 7. Do not just give the correct answer; briefly explain your reasoning or evidence, or an example, in each case. Don't copy and paste lecture notes or other sources; write briefly in your own words.

You should write down the question number and any relevant letters, but you do not need to reproduce the text of each question. When we check your submission, your entire answer for Part 3 (including question numbers/letters) **should not exceed 800 words.** (This means an average of 100 words per question, but clearly, as some questions carry more marks or are more involved than others, you might expect to use more words on some questions than others).

Sensors questions (10%)

1. [2 marks] Consider gyroscopes, accelerometers and magnetomers, the three components of your Grove IMU-9DOF. Which two of these sensors are 'proprioceptive' and why? Why is the other one 'exteroceptive'?
2. [4 marks] Gyroscopes, accelerometers and magnetometers are all typically described as passive sensors. Turning to infrared (IR) sensors, some are passive while others are active. Explain why each of the five types of sensor is 'passive' or 'active', and give one other example of an 'active' sensor.
3. [4 marks] Explain a single disadvantage of each of the following sensor types:
    a. GPS
    b. Magnetometer
    c. Mechanical gyroscope

Linux inter-process communications (IPC) and multi-threading (10%)

4. [2 marks] **True or False?** "Concurrency is defined as making progress on more than one task at the same time. However, when the computer has one processor the application may not process more than one task at a given time." Discuss your answer briefly. Some parts of the statement might be true, some false.

5. [2 marks] **True or False?** "C++ and C come with 'garbage collection' out of the box. This feature allows automatic memory management that runs in the background, and attempts to reclaim garbage, or memory that's no longer being used by the program." Discuss your answer briefly. Some parts of the statement might be true, some false.

6. [1 mark] **True or False?** "The pipe command (|) in the command line interface is used to combine two small functions together and comes in two types: named and unnamed." Provide an example to support your answer.

7. [5 marks] It is claimed that the following is a correct analogy of the function of a semaphore used in inter-process communications:

   > "You are driving an electric car and after some mileage the electric car requires you to charge it. You look around and find a charging station that has four empty charging stations.
   >
   > The number of available charging stations are analogous to a thread, as it allows the access to a resource and the cars are analogous to semaphores as they are tapping into a resource."

   Do you agree with this analogy? Why / why not?