

## CMPS111 Spring 2018

### Homework 1

Marks Available: **25 (5% of final course mark)**

Submission:

Due: **23:59 Wednesday April 18, 2018**  
Format: **Single PDF Document**  
Where: **Canvas**

**(5 marks)** *Question 1.* Briefly outline the evolution of Operating Systems from those used by the earliest stored program computers of the 1940s to their modern counterparts.

**(5 marks)** *Question 2.* In the following piece of C code, how many processes are created when it is executed? Explain your answer.

```
int main() {  
    fork();  
    fork();  
    fork();  
    exit(1);  
}
```

**(5 marks)** *Question 3.* If an Operating System assigns an unsigned 32bit integer to store current time as the number of seconds elapsed since 00:00 on January 1 1970, is this likely to be a problem? Explain your answer.

**(5 marks)** *Question 4.* Describe how a web server might leverage multi-threading to improve performance. Include diagrams if you feel this will make your answer clearer.

**(5 marks)** *Question 5.* (a) In a multiprogrammed environment with 16MB of memory where all processes require 1MB of unshared memory and spend 60% of their time in I/O wait, calculate how much memory will remain unused when approximately 99% CPU utilization is achieved. (b) In the same multiprogrammed environment, if each process now requires 3MB of unshared memory, calculate the maximum achievable CPU utilization. Show all your work.