NWEN 301 2021 T2 [20 Marks]
Assignment 2

Due: refer to the dates and times in the submission system

SUBMISSION INSTRUCTIONS:

- Submit using the submission system for NWEN301
- Submit one PDF file only

Question 1 [3 Marks]

(a) Outline what is meant by a zombie process in a Unix like system.

(b) How does the zombie process 'disappear'?

(c) How is a zombie process different from an orphaned process?

Question 2 [3 Marks]

In lecture 5, slide 5 we see a web server implemented using threads - the model consists of one dispatcher thread and a variable number of worker threads that service each incoming HTTP request. Assume that each incoming request results in an access to the file system in order to return the requested html file in the HTTP response. The writer of the web server is really keen to utilise user threads as they are very fast and have little overhead.

(a) What is the major shortcoming of user threads in the outlined scenario?

(b) What is the resultant impact on the performance of the web server?

(c) How could our OS be changed to potentially solve this shortcoming (hint, the answer is NOT to use kernel threads!).

Question 3 [3 Marks]

(a) What is busy waiting?
(b) What is the primary advantage of busy waiting?
(c) When is busy waiting a **good** idea?

Question 4 [2 Marks]

Why can’t we use interrupts to enforce mutual exclusion on a multi-cpu system?

Question 5 [3 Marks]

(a) Consider a system with 12 instances of a particular resource type and four processes: P0, P1, P2 and P3. The table below shows the maximum needs and the currently allocated resource instances for each process.

Process	Maximum	Allocated
P0	9	5
P1	4	1
P2	8	2
P3	5	1
free		3

State if the system is in a safe state and justify your answer.

Question 6 [6 Marks]

Write a pseudo code implementation of semaphores P() and V() using the atomic swap instruction instead of turning off interrupts. Your solution should avoid busy waiting as much as possible (you can spin on the swap but not the semaphore) - descriptive text/comments in your code to outline the operations are perfectly acceptable. *Hint: look at the code in class for swap and for the pintos semaphores.*