COMPSCI 3SH3 Winter, 2021

Assignment/Homework 1, Jan. 29th 2021
Assignment due date: Feb. 14th Sun, 23:59:59.
Note: Please work on this assignment individually. Students copying each other's answer will get a zero and will perform poor on midterm and final.

1. **Ethics** (10 Marks) Consider the following situation: Suppose that you are a development engineer with responsibility for an embedded system employed in one of your company's major products. You seek to improve the efficiency of your software system and, following some research, you discover an algorithm posted on the Web that would provide a vast improvement for your system. The algorithm is written in the same language as that used by your system.

   a) (5 Marks) Would it **ever** be ethical to copy the code that implements the algorithm and incorporate it in your embedded system?

   b) (5 Marks) Would it **ever** be good engineering practice to incorporate the code that implements the algorithm in your system?

2. **Introduction** (10 Marks)
   Q1 (1.14) (4 marks): What is the purpose of interrupts? How does an interrupt differ from a trap? Can traps be generated intentionally by a user program? If so, for what purpose?
   Q2 (1.16) (6 marks):
   Direct memory access is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.

   (a) (2 marks) How does the CPU interface with the device to coordinate the transfer?

(b) (2 marks) How does the CPU know when the memory operations are complete?

(c) (2 marks) The CPU is allowed to execute other programs while the DMA controller is transferring data. Does this process interfere with the execution of the user programs? If so, describe what forms of interference are caused.

3. **OS Structures** (10 Marks)

Q1 (6 marks): How are iOS and Android similar? How are they different?

Q2 (4 marks):

(a) (1 mark) What is the purpose of system calls?

(b) (1 mark) What is the purpose of system programs?

(c) (2 marks) What is the purpose of the command interpreter? Why is it usually separated from the kernel?

4. **Processes** (10 Marks)

a) **Question: 3.13** (4 marks)
Using the program in Listing 1, identify the values of pid at lines A, B, C, and D. (Assume that the actual pids of the parent and child are 2600 and 2603, respectively.)

Listing 1: What are the pid values?

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
int main() {
pid t pid, pid1;

    /* fork a child process */ pid = fork();
    if (pid < 0) { /* error occurred */
        fprintf(stderr, "Fork Failed");
        return 1;
    }
    else if (pid == 0) { /* child process */
        pid1 = getpid();
        printf("child: pid = %d",pid); /* A */
        printf("child: pid1 = %d",pid1); /* B */
    }
    else { /* parent process */
        pid1 = getpid();
        printf("parent: pid = %d",pid); /* C */
        printf("parent: pid1 = %d",pid1); /* D */
        wait(NULL);
   }

   return 0;
}
```

b) **Question: 3.3** (6 marks)

Original versions of Apple's mobile iOS operating system provided no means of concurrent processing. Discuss three major complications that concurrent processing adds to an operating system.