B.Sc. Engg. / HD CSE 5th Semester

19 March 2018 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2017-2018**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

CSE 4501: Operating Systems

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Draw the process state diagram. 5
   b) What is context switch? Show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated. 1+7
   c) Describe the differences among short-term, medium-term, and long-term scheduling. 3×3
   d) What are the three main purposes of an operating system? 3

2. a) What is deadlock? Explain a scenario in terms of OS that might lead to deadlock. 1+4
   b) Race conditions are possible in many computer systems. Consider a banking system that maintains an account balance with two functions: deposit(amount) and withdraw(amount). These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance. Assume that a husband and wife share a bank account. Concurrently, the husband calls the *withdraw()* function and the wife calls *deposit()*. Describe how a race condition is possible and what might be done to prevent the race condition from occurring. 10
   c) What are the five major activities of an operating system with regard to process management? 5
   d) Keeping in mind the various definitions of operating system, consider whether the operating system should include applications such as web browsers and mail programs. Argue both that it should and that it should not, and support your answers. 5

3. a) Including the initial parent process, how many processes are created by the program shown below 4

```
#include <stdio.h>
#include <unistd.h>
int main()
{
        /* fork a child process */
        fork();
        /* fork another child process */
        fork();
        /* and fork another */
        fork();
        return 0;
}
```

   b) What are the two models of inter process communication? What are the strengths and weaknesses of the two approaches? 10
   c) Write down the advantages of multiprocessing system. Differentiate between symmetric and asymmetric multiprocessing. 7
   d) What is semaphore? What are the three major activities of an operating system with regard to memory management? 1+3

4. a) The two processes, P0 and P1, share the following variables:

```
boolean flag[2]; /* initially false */
int turn;
```

The structure of process *Pi* (i == 0 or 1) is as below:

```
do {
 flag[i] = true;
 while (flag[j]) {
  if (turn == j) {
   flag[i] = false;
   while (turn == j)
    ; /* do nothing */
   flag[i] = true;
  }
 }
 /* critical section */
 turn = j;
 flag[i] = false;
 /* remainder section */
} while (true);
```

The other process is Pj (j == 1 or 0). Prove that the algorithm satisfies all three requirements for the critical-section problem.

b) What is the Dining Philosophers problem? Explain the problem scenario and the two results it might lead to. Provide two approaches that can solve it with explanation. 2+4+4

c) Define API and System Call. Why API is used rather than system calls? 1+2