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

MID SEMESTER EXAMINATION   WINTER SEMESTER, 2016-2017
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) What is an Interrupt? How are interrupts handled by operating systems? 2+4
   b) Thread is sometimes called a 'lightweight process' or 'process within process'-explain why thread is called so with necessary diagrams. 6
   c) Define deadlock in process management. What are the necessary conditions that must arise simultaneously to have a deadlock situation? 5
   d) Given a resource (A,B,C,D) allocation between five processes (P_1 to P_5) given below (Table 1), determine whether the system is in safe state or unsafe state. While determining the state of the system, elaborately show your calculations. If the system is in safe state, provide an example allocation of resource to a process that will make the system unsafe. 8

Table 1: Resource allocation state in five processes

Process	Allocated				Maximum Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_1	0	0	1	2	0	0	1	2	2	1	0	0
P_2	2	0	0	0	2	7	5	0				
P_3	0	1	3	4	6	6	5	6				
P_4	2	3	5	4	4	3	5	6				
P_5	0	3	3	2	0	6	5	2				

2. a) What is a system call? Write the names of six process related system calls. 2+3
   b) Define shared data, race condition and critical section in the context of synchronization. 2×3
   c) What is a Process? What are the states a Process may go thorough before it terminates? 2+3
   d) Briefly describe Memory mapping, Message Passing and Socket as standard IPC mechanisms. 3×3

3. a) What is a Ready Queue? How does operating system implement Ready Queue? 6
   b) What is a semaphore? What are the two atomic operations of semaphore? Briefly describe with pseudo-code. 2+4
   c) What is logical address? How is logical address translated to physical address in contiguous (multi partition) memory allocation scheme? 3+4
   d) Given the code snippet below in Figure 1, what is the output of the same code? 6

```
#include <sys/types.h>
#include <sys/wait.h>
#include <stdlib.h>
#include <unistd.h>

int main(int argc, char* argv[]){
    int value=3;
    pid_t cpid;
    cpid=fork();
```

```
if (pid==0){
    for(int i=1;i<3;i++){
        value+=10;
        printf("value in child = %d\n",value);
        execl("/bin/ls","ls", NULL);
        printf("child process\n");
    }//for
}else if (pid >0){
    waitpid(pid, NULL,0);
    printf("value in parent = %d\n",value);
    exit(0);
    /*printf("parent process\n";*/
}//else if
else{
    printf("fork error.\n");
}

return 0;
}//main
```

Figure 1: A process exercise program

a) Suppose, the OS maintains 03 (three) different ready queues: first two queues for Interactive 6+4 processes and the last one for Batch jobs. Interactive processes are scheduled in RR manner whereas Batch jobs are scheduled by FCFS algorithm. The first interactive queue has a quantum time of 2ms and the second interactive queue has a quantum time of 6ms. Processes are scheduled in the policy that 'no processes in a lower priority queue will be served until a process in higher priority queue exists'. Assume first queue has the highest priority and third queue has the lowest priority. Interactive processes mostly finishes within 8ms. To avoid starvation, the priority of a process in first two queues will be reduced by one (shifted to lower queue) once it gets the CPU. If an interactive job is placed in queue number three, it becomes batch job. By default interactive jobs enter into the first queue.

A set of processes have arrived at the CPU according to the chart given below in Table 2:

Table 2: Burst time requirements of processes and process types

Process	Burst Time in ms	Type (Interactive/Semi
P1	5	I
P2	16	I
P3	3	I
P4	8	I
P5	17	I

Draw the Gantt chart for the processes and determine the average waiting time for them.

b) What is dual mode operation in Operating Systems? Why is it necessary? 6

c) Processor and I/O devices can operate independently- define the role of device controller in the implementation of it. 5

d) Define PCB. 4