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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**

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 **3 (three)** questions. Answer all of them.

Figures in the right margin indicate marks.

File naming format: "**Student ID_C4501M.pdf**"

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1. a) What is Context Switch? What entity is required to represent a process in the OS? Describe the process of Context Switching with appropriate process timeline diagram. — 2 + 1 + 5 (CO1, CO2) (PO1, PO4, PO10, PO12)

   b) Explain how interrupt driven I/O operation is accomplished. For transferring large amount of data is there any alternative to interrupt driven approach? If yes, how does it work and what are its benefits? — 4 + 1 + 3 (CO1, CO2, CO3) (PO1, PO4, PO10, PO12)

   c) Write short notes on the following — 3 × 3 (CO1, CO3) (PO1, PO4, PO10, PO12)
      i. Graceful degradation.
      ii. Thread pool.
      iii. Thread cancellation.

2. a) "*All Orphan processes are Zombie processes but all Zombie processes are not Orphan processes.*"- Explain with appropriate scenario and process timeline diagram. — 7 (CO1, CO3) (PO1, PO4, PO10, PO12)

   b) Suppose you have a list of $\boldsymbol{n}$ numbers and your workstation has **4** processing cores. Now, consider the following two scenarios-

   Scenario I-
   You **divide** the list of numbers in **two equal halves**. For the numbers in the **first half**, you have to find their **summation** and for those in the **second**, you have to find their **product**. Finally, you have to find the **difference** between the **summation** and the **product**.

   Scenario II-
   You have to find the **difference** between the **summation** and the **product** of **all** the **numbers** in the list.

   Answer the following questions-
      i. How will you utilize all the processing cores in each of these scenarios? Explain separately. — 3
      ii. What type of parallelism will you implement in each of these scenarios? Justify your answer. — 3
      iii. Given 4 processing cores, will you get the same computational gain in both scenarios? Explain mathematically using Amdahl's law. — 12

   (CO1, CO2, CO3, CO4, CO5) (PO1, PO2, PO4, PO10, PO12)

```c
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>

#define SIZE 5

int nums = {0, 1, 2, 3, 4};

int main(){
   int i;
   pid_t pid;

   pid = fork();

   if(pid == 0){
       for(i = 0; i < SIZE; i++){
          nums[i] *= -i;
           printf("%d ", nums[i]); /* LINE A */
       }
   }
   else if(pid > 0){
      wait(NULL);
       for(i = 0; i < SIZE; i++){
          printf("%d ", nums[i]); /* LINE B */
       }
}
```

Code Listing 1

3. a) Using the program in **Code Listing 1**, generate the outputs at **LINE A** and **LINE B**. In which program space will **LINE A** be executed, parent or child? Justify your answer. — 4 + 3 (CO1, CO3, CO4) (PO1, PO2, PO4)

   b) What are the differences between RPC and RMI? Are there any issues with RPC that must be handled for ensuring proper communication? If yes, describe them briefly. — 3 + 5 (CO1, CO2, CO3) (PO1, PO4, PO10, PO12)

   c) What are CPU bound and I/O bound processes? Why is a good mix of these two types of process necessary? What type of scheduler ensures a good mix of processes? Explain its working mechanism with diagram. — 2 + 2 + 6 (CO1, CO2, CO3) (PO1, PO4, PO10, PO12)