National University of Computer and Emerging Sciences

Karachi Campus

Operating Systems (CS 2006)

Sessional-II Exam

Date: April 6th, 2024

Course Instructor(s)

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Total Time (Hrs): 1

Total Marks: 15

Total Questions: 2

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Roll No Section Student Signature

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Attempt all the questions.

CLO # 1: Describe, discuss, and analyze, services provided by the modern Operating Systems.

Q1. [6 marks]

a) Consider the following five processes. All arrive at time zero, in the order listed, with the length of the CPU burst given in milliseconds:

```
Process:    p1, p2, p3, p4, p5
Burst Time: 10, 29, 3, 7, 12
```

Consider the First Come First Serve, non-preemptive Shortest Job First, and Round Robin with time quantum ten milliseconds scheduling algorithms for this set of processes. *Note: Perform all calculations as per the textbook.*

i. Workout the average waiting times for all three algorithms along with their respective Gantt charts. [2]

ii. Name the algorithm that will perform best based on your calculations. Explain reasons for your selection. [1]

b) How a multilevel feedback queue scheduling algorithm separate processes in different priority queues? [1]

c) Recall the threading concepts covered from the textbook. Now, **compare** the following:

i. Concurrent execution vs Parallel execution [1]

ii. Task parallelism vs Data Parallelism [1]

CLO # 2: Understand, design, and implement solutions employing concepts of Processes/Threads.

Q2. [9 marks]

a) Suppose you have written a multithreaded C program using Pthread library that creates ten threads to solve a problem. You also determine that 20% of execution remains serial. Now answer the following: [1.5 + 1.5]

i. **How much speedup** do we get if we run the program on a computing unit having ten cores?

ii. **Explain** what happens if the same program runs on a single CPU, single core system.

b) Write a **C program** using the Pthread library that performs a parallel assignment of random numbers to an integer array of three hundred elements using three threads. *Note: There will be no partial award if incorrect syntax or logic.* [1.5 (syntax) + 1.5 (logic) = 3]

c) Consider the situation illustrated in Figure 1 where two processes, running in parallel, try to execute the fork () system call at the same time. During execution, both fork () system calls request pid, which involves the identifier **next_available_pid**. Now, explain the synchronization problem shown in this diagram by answering the following questions: *Note: No coding required.* [1.5 + 1.5]

i. How do they get the same value? **Explain**.

ii. **Discuss** a solution using which they get a unique value?

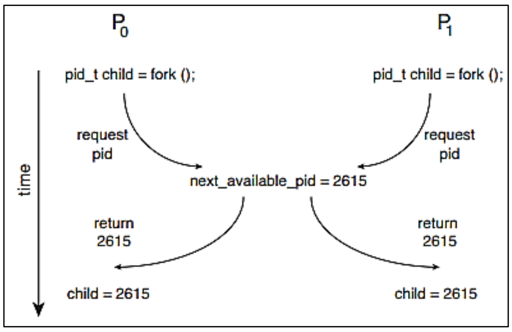

Figure 1: Q2 part (c)

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