**SIR SYED UNIVERSITY OF ENGINEERING & TECHNOLOGY**

**SOFTWARE ENGINEERING DEPARTMENT**

**SPRING 2022**

**OPERATING SYSTEMS (SWE-204T)**

**Assignment 2**

Semester: IV Batch: 2020F

Due Date: **13-June-2022** Max Marks: 3

Instructions:

* **Late Submissions** will not be acknowledged.
* **Plagiarism of your assignment will not be more than 20%** otherwise marks will be deducted.

**Question 1**

1. Consider the following data of a system has five processes (P0, P1, P2, P3 and P4) and four types of resources (A, B, C and D). There are multiple resources of each type. Is the following state safe or not? If it is, show how the processes can complete. If not, show how they can deadlock.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Processes** | **Allocation** | | | | **Maximum** | | | | **Available** | | | |
|  | **A** | **B** | **C** | **D** | **A** | **B** | **C** | **D** | **A** | **B** | **C** | **D** |
| P0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 1 | 5 | 2 | 0 |
| P1 | 1 | 0 | 0 | 0 | 1 | 7 | 5 | 0 |  |  |  |  |
| P2 | 1 | 3 | 5 | 4 | 2 | 3 | 5 | 6 |  |  |  |  |
| P3 | 0 | 6 | 3 | 2 | 0 | 6 | 5 | 2 |  |  |  |  |
| P4 | 0 | 0 | 1 | 4 | 0 | 6 | 5 | 6 |  |  |  |  |

1. Draw the resource-allocation graph when the sets Process, Resource, and Edges are:

**P = {T1, T2, T3, T4}**

**R = {A, B, C, D}**

**E = {T1🡪B, A🡪T1, A🡪T2, B🡪T2, T3🡪B, C🡪T3, T2🡪C, T4🡪C, D🡪T3 and D🡪T4}**

Assume there exists two instances of resource A and D one instance of resource B and C. As well, assume resources A, B, C and D are non-preemptive and cannot be shared.

* 1. Draw wait-for-graph with the help of resource allocation graph.
  2. Could a deadlock exist in the system? Briefly explain.

**Question 2**

Suppose that a scheduling algorithm (at the level of short-term CPU scheduling) favors those processes that have used the least processor time in the recent past. Why will this algorithm favor I/O-bound programs and yet not permanently starve CPU-bound programs?

**Question 3**

The following pair of processes share a common set of variables: “counter”, “temp A” and “temp B”

**Process A Process B**

A1: tempA = counter+1; B1: tempB = counter+2;

A2: counter = tempA; B2: counter = tempB; The variable “counter” initially has the value 10 before either process begins to execute.

1. What difference values of “counter” are possible when both processes finished executing? Give an order of execution of statements from process A and B that would yield each of the values you give. For example, execution order A1, A2, B1, and B2 would yield the value 13.

(**i**) Modify the above programs for processes A and B by adding appropriate signal and wait operations on the binary semaphore “sync” such that the only possible final value of “counter” is 13. Indicate what should be the initial value of the semaphore “sync”.

**Question 4**

This problem was originally based on the Senate bus at Wellesley College. Riders come to a bus stop and wait for a bus. When the bus arrives, all the waiting riders invoke boardBus, but anyone who arrives while the bus is boarding must wait for the next bus. The capacity of the bus is 50 people; if there are more than 50 people waiting, some will have to wait for the next bus. When all the waiting riders have boarded, the bus can invoke depart. If the bus arrives when there are no riders, it should depart immediately. Write synchronization code using Semaphore.

**Question 5**

Suppose we have 64bit logical address with 8KB of page size and size of each entry in the page is 4 Bytes. Calculate the following:

* 1. Inner page size.
  2. Outer page size
  3. Page offset