**Final Exam – 100 points**

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|  |  |
| --- | --- |
| **1. (*15 points*)** |  |
| **2. (*15 points*)** |  |
| **3. (*15 points*)** |  |
| **4. (*20 points*)** |  |
| **5. (*15 points*)** |  |
| **6. (*20 points*)** |  |
| **Total (100 points)** |  |

1. (15 points) Consider the following set of jobs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Job Number | 1 | 2 | 3 | 4 |
| Arrival Time | 0 | 1 | 4 | 7 |
| CPU burst Time | 6 | 2 | 4 | 2 |

Clearly show the scheduling of these jobs by the **Gantt chart** (12 points) using the scheduling algorithm of **shortest remaining time first.** If there are serval jobs having same remaining time, first come, first served scheduling algorithm will be applied. After drawing the Gantt chart, please compute average response time (3 points).

Your answer:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P1 | P2 | P1 | P1 | P1 | P4 | P3 |

0 1 3 4 7 8 10 14

**-**

2. (15 points) Consider a 64MB memory system using simple paging scheme. Each page is of size 1KB (1024 bytes).

1) (5 points). How many bits are required to address the entire memory?

2) (5 points). How many bits are required to address the offset within each page?  
 3) (5 points). What is the problem in addressing if both the page and frame are of size 1000 bytes? (5 points)

Your answer:

1)

2)

3)

3. (15 points) Consider the following snapshot of a system:

# 

Answer the following questions using the banker’s algorithm:

1. (5 points). What is the content of the matrix Need?

Max – Allocation

2) (10 points). Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.

Your answer: < P3, P4, P0, P2, P1 >

4. (20 points) Assuming a **2-KB** page size, what are the page numbers and offsets for

the following address references (provided as decimal numbers):

1) (5 points). 3085 Page:

2) (5 points). 42095

3) (5 points). 215201

4) (5 points). 650000

Your answer:

Page: 3085 / 2048 = 2, 42095

Offset: 3085 mod 2048 = 1037

Page: 42095 / 2048 = 21

Offset: 42095 mod 2048 = 1135

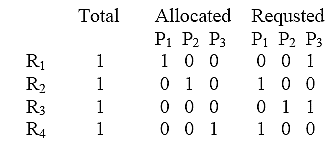
5. (15 points) Write a program that demonstrates thread cooperation. Suppose that you create and launch two threads, the first thread keeps printing numbers starting from 1, 2, 3, …, until 200. When the printed number is dividable by 10, the second thread will print the current system time; when the printed number is not dividable by 10, the second thread should wait. It does not matter if the first thread waits or continues when the second thread is printing the system time.

Files provided in submission

6. (20 points) Given the current system state where R1, R2, R3, and R4 are resources while P1, P2, and P 3 are processes.

1) (12 points) Please draw resource-allocation graph and check whether there is a cycle.

2) (4 points) If the graph contains a cycle, clear indicate which processes and resources are involved in the cycle.   
3) (4 points) Please check if the system is deadlocked. Is there any process which can be finished? If yes, which process?



Your answer: