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OFFICE OF CONTROLLER OF EXAMINATIONS

PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

UE18CS302

OCTOBER 2020: IN SEMESTER ASSESSMENT
B. Tech.
SEMESTER TEST – 1
UE18CS302 (4 credit subject) - Operating System

Time: 2 Hrs	Answer All Questions	Max Marks: 60

1. a) Clearly explain different states of the process drawing state diagram — **4**

Answer:

Refer to section 3.1.2 and Figure 3.2 of Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer.

Proportional Marking with Full marks only if all states are explained with correct state transition diagram

b) Precisely Explain fork(), exec(), and wait() system calls including parameters and return value — **3**

Answer:

Refer to section 3.3.1 of Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer.

Marks according/proportional to system calls that are explained correctly with parameter and return values

c) Precisely and Clearly Explain Primary benefits of Multiprocessor Based Systems — **3**

Answer:

Refer to section 1.3.2 of Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer.

Full marks only if three primary benefits i.e., increased throughput, increased reliability and Economy of scale precisely and clearly explained

2. **5 (1+2+2)**

a) Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed as Burst Time. In answering the questions, use non-preemptive scheduling, and base all decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P1	0.0	8
P2	0.4	4
P3	1.0	1

1. What is the average turnaround time for these processes with the First Come First Serve (FCFS) scheduling algorithm?
2. What is the average turnaround time for these processes with the Shortest Job First

(SJF) scheduling algorithm?

3. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling.

Answer:

a) Average Turnaround Time: ((8-0)+(12-0.4)+(13-1.0)) / 3 = 10.53
b) Average Turnaround Time: ((8-0)+(13-0.4)+(9-1.0)) / 3 = 9.53
c) Average Turnaround Time: ((14-0)+(6-0.4)+(2-1.0)) / 3 = 6.86

Turnaround time is finishing time minus arrival time, one have to subtract the arrival times to compute the turnaround times.

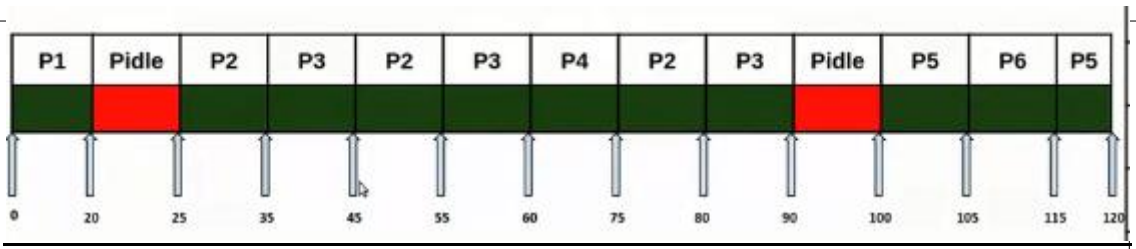
Proportional marking to the extent of correctness with max marks, 1,2, 2 for part 1, 2, 3 respectively

b) **The following processes are being scheduled using a pre-emptive, round-robin scheduling algorithm. Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. In addition to the processes listed below, the system also has an idle task (which consumes no CPU resources and is identified as P_{idle}). This task has priority 0 and is scheduled whenever the system has no other available processes to run. The length of a time quantum is 10 units. If a process is pre-empted by a higher-priority process, the pre-empted process is placed at the end of the queue** 5(2+2+1)

Thread	Priority	Burst	Arrival
P_1	40	20	0
P_2	30	25	25
P_3	30	25	30
P_4	35	15	60
P_5	5	10	100
P_6	10	10	105

1. What is the turnaround time for each thread?
2. What is the waiting time for each thread?
3. What is the CPU utilization rate?

Answer:



1.p1: 20-0 = 20, p2: 80-25 = 55, p3: 90 - 30 = 60, p4: 75-60 = 15, p5: 120-100 = 20, p6: 115-105 = 10
2. p1: 0, p2: 30, p3: 35, p4: 0, p5: 10, p6: 0
3. 105/120 = 87.5 percent.

Proportional marking to the extent of correctness with max marks, 2, 2, and 1 for part 1, 2, 3 respectively

3. a) Precisely and Clearly Explain Four necessary Conditions to occur simultaneously for Deadlock **4**

Answer:

Refer to section 7.2.1 Text book 1 Operating System Concepts by Silberschatz et al. 9^{tn} edition (2016 Indian version) for answer.

Proportional marking. All the 4 conditions need to be clearly and precisely explained to award full marks.

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b) Precisely and Clearly Explain primary benefits of multithreading an applications **3**

Answer:

		Refer to section 4.1.2 Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer. Proportional Marking. At the least 3 out of 4 benefit to be explained clearly and precisely to get full marks.	
	c)	Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Show that the system is deadlock-free. **Answer:** Suppose the system is deadlocked. This implies that each process is holding one resource and is waiting for one more. Since there are three processes and four resources, one process must be able to obtain two resources. This process requires no more resources and, therefore it will return its resources when done.	3
4.	a)	Give the correct and concise structure of reader and write process using semaphores for the first reader writer problem where no reader be kept waiting unless a writer has already obtained permission to use the shared object. Obviously, readers can access the shared object simultaneously. **Answer:** Refer to section 6.7.2 in conjunction with Figures 6.11 and 6.12 of Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer. 3 marks for correct structure of reader process and 2 marks for correct structure of writers	5 (3+2)
	b)	Give a clear, correct and complete algorithm for deadlock detection among n processes and m resources type with multiple instances. Mention the complexity of the algorithm. **Answer:** Refer to section 7.6.2 with 4 step algorithm, All 4 step to be correct to get 4 marks Complexity 0(mxn^2) to be correct to get 1 additional marks	5 (4+1)
5.	a)	Clearly Explain all the Steps to Service a Page Fault in a demand paging based system **Answer:** Refer to section 9.2.2 of Text book 1 Operating System Concepts by Silberschatz et al. 9th edition (2016 Indian version) for answer. Proportional Marking and all steps to be mentioned to get full marks	4
	b)	Clearly Differentiate between internal fragmentation and external fragmentation with example **Answer:** Refer to section 8.3.3 of Text book 1 Operating System Concepts by Silberschatz et al. 9tn edition (2016 Indian version) for answer. Proportional Marking based on extent of correctness of answer.	3
	c)	Clearly explain and Differentiate between Frame Allocation and Page replacement **Answer:** Refer to 9.4 and 9.5 in conjunction with chapter 9 summary to mark for difference proportionally of Text book 1 Operating System Concepts by Silberschatz et al. 9tn edition (2016 Indian version) for answer. Proportional Marking based on extent of correctness of answer.	3
6	a)	Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB,	5 (4+1)

112 KB, and 426 KB (in order)?Which algorithm makes the most efficient use of memory?

Answer:

1. First-fit: 212K is put in 500K partition, 417K is put in 600K partition, 112K is put in 288K partition (new partition 288K = 500K − 212K), 426K must wait

2. Best-fit: 212K is put in 300K partition, 417K is put in 500K partition, 112K is put in 200K partition 426K is put in 600K partition

3. Worst-fit: 212K is put in 600K partition, 417K is put in 500K partition, 112K is put in 388K partition, 426K must wait

Best-fit turns out to be the best

Proportional Marking to the extent of correct marks for the 3 algorithm x 4 sizes Additional one mark for correctly spotting most efficient algorithm

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b) Consider the segment table as follows : **5**

Segment	Base	Limit
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1352	96

What are the Physical address for the following logical address

Seg	Offset
0	430
1	10
2	500
3	400
4	112

Answer:

1. **219 + 430 = 649**
2. **2300 + 10 = 2310**
3. **illegal reference, trap to operating system**
4. **1327 + 400 = 1727**
5. **illegal reference, trap to operating system**

Proportional Marking and mention of trap on illegal reference to get complete marks.