King Saud University

College of Computer and Information Sciences
Computer Science Department

Course Code:	CSC 227
Course Title:	Operating Systems
Semester:	Fall 2017-2018
Type of Examination:	Midterm 2Exam.

Student Name:	
Student ID:	
Student Section No.	
Instructor Name:	

Tick the Relevant	Computer Science B.Sc. Program ABET Student Outcomes	Question No. Relevant Is Hyperlinked	Covering %
X	a) Apply knowledge of computing and mathematics appropriate to the computer science;	Q.1	25%
X	b) Analyze a problem, and identify and define the computing requirements appropriate to its solution	Q.2-Q.4	50%
X	c) Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;	Q.5	25%
X	d) Function effectively on teams to accomplish a common goal;		

	Full Mark	Student's Mark
Question No.1	5	
Question No.2	3.5	
Question No.3	3.5	
Question No.4	3.5	
Question No.5	3.5	
Total	20	

Student's Name:……Student's ID……

Question 1. [5 Marks: CLO (a)] Select ONLY ONE ANSWER (the best answer).

Copy your answer for question 1-1 to 1-16 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	The address of the next instruction to be executed by the current process is provided by the:
A.	Program counter
B.	CPU registers
C.	Process stack
D.	Pipe

2.	When a process is considered in a ready state?
A.	when process is scheduled to run after some execution
B.	when process is unable to run until some task has been completed
C.	when process is using the CPU
D.	none of the mentioned

3.	A parent process may terminate execution of its child process when the:
A.	Child has exceeded allocated resources
B.	Child did not cooperate very well
C.	Child is sleeping
D.	None of the above

4.	exec system call used after a fork to:
A.	Create a new process
B.	Terminate a process
C.	Duplicate the process
D.	replace the process' memory space with a new program

5.	Which module gives control of the CPU to the process selected by the short-term scheduler?
A.	dispatcher
B.	interrupt
C.	scheduler
D.	none of the mentioned

6.	The processes that are residing in main memory and are ready and waiting to execute are kept on a list called
A.	job queue
B.	ready queue
C.	execution queue
D.	process queue

7.	The interval from the time of submission of a process to the time of completion is termed as
A.	waiting time
B.	turnaround time
C.	response time
D.	throughput

8.	Processes are classified into different groups in:
A.	round robin scheduling algorithm
B.	priority scheduling algorithm
C.	multilevel queue scheduling algorithm
D.	shortest job scheduling algorithm

Student's Name:…….Student's ID…….

9.	A memory buffer used to accommodate a speed differential is called?
A.	stack pointer
B.	cache
C.	accumulator
D.	disk buffer

10.	What hole will allocates in "worst-fit" algorithm of memory management?
A.	It allocates the smaller hole than required memory hole.
B.	It allocates the smallest hole from the available memory holes.
C.	It allocates the largest hole from the available memory holes.
D.	It allocates the exact same size memory hole.

Please copy your answer for question 1-1 to 1-12 in the following table:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
A	A	A	D	A	B	B	C	B	C

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Question 2. [3.5 Marks: CLO4 – SO(a)]

1. You have the following program:

```
#include <stdio.h>
#include <unistd.h>
main()
{
int i;

fork();
fork();
printf("Tweet \n");

for (i=0; i<2 ;i++)
{
        fork();
}
}
```

1.1 Show the output of this program. (1 Mark)

```
Tweet
Tweet
Tweet
Tweet
```

1.2 How many processes in total (created and including the parent process) are expected to run? (1 Mark)

The first process will create a child. Then the parent and the child each of which will create a child
ending up with 4 processes
each process will print Tweet (4 lines)
Then a for loop with a fork() that will add two levels of children (16 processes in total)

2. Processes might need to cooperate with each other, Why (list at least three reasons) (1.5 Mark)

Information sharing
Computation speedup
Modularity
Convenience

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Question 3. [7 Mark]

3.1 Short-term scheduler selects from among the processes in ready queue, and allocates the CPU to one of them. Describe the **four** conditions when CPU scheduling decisions may take place. **(2 Mark)**

when a process Switches from running to ready state
when a process Switches from waiting to ready
when a process Switches from running to waiting state
when a process Terminates

3.2 Considering the process arrival time chart given below, **draw** the **Gantt charts** to illustrate how these processes would be scheduled using **Round Robin (RR)** and **First-come First-Served (FCS)** scheduling, and calculate the waiting time **for each process**. **(5 Marks)**

Process	Arrival time	Burst Time
P1	0	16
P2	0	10
P3	6	4
P4	7	6
P5	8	10

Notes.

- If when choosing a process to schedule next you could legally choose any of a number of processes, choose the one with the lowest-numbered name; i.e., **choose p_i over p_j if i < j**.
- Do not include context-switching time in your chart. Assume that the **quantum is set to 5** time units.

3.2.1 Gantt chart and waiting time for RR: (2.5 Mark)

Answer:

P1	P2	P1	P3	P4	P5	P2	P1	P4	P5	P1

0 5 10 15 19 24 29 34 39 40 45 46

The wait times for each process are calculated by the formula time of completion-arrival time - burst time. Therefore:
Wait times: p1: 30, p2: 24, p3: 9, p4: 27, p5: 27

Average waiting time = (30+24+9+27+27) / 5 = 46.8

3.2.2 Gantt chart and waiting time for FCFS: (2.5 Mark)

Answer:

P1	P2	P3	P4	P5

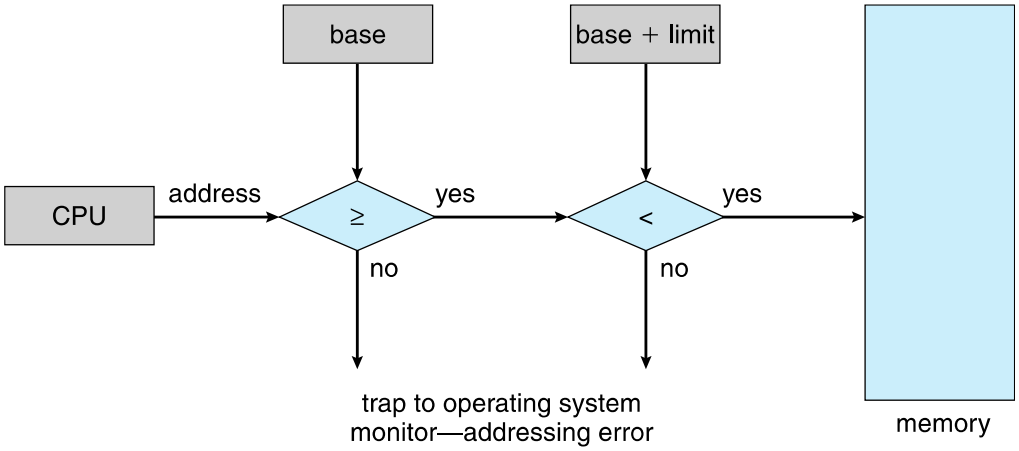
0 16 26 30 36 46

The wait times for each process are calculated by the formula time of completion-arrival time - burst time. Therefore:
p1: 0, p2: 16, p3: 20, p4: 23, p5: 28
Average waiting time = (0+16+20+23+28) / 5 = 17.4

Student's Name:……Student's ID……..

Question 4. [3.5 Mark]

4.1 Complete the appropriate text and conditions of the hardware address protection mechanism discussed in the classroom. **(1 Mark)**



4.2 Address binding of **instructions** and **data to memory** addresses can happen at three different stages, describe each stage with respect to the appropriate knowledge about memory location. **(1.5Marks)**

Binding stage	**Description**
Compile time:	If memory location known a priori, **absolute code** can be generated; must recompile code if starting location changes
Load time:	Must generate **relocatable code** if memory location is not known at compile time.
Execution time:	Binding delayed until run time if the process can be moved during its execution from one memory segment to another.

4.3 List and describe the three memory allocation algorithms covered in lectures. **(1 Mark)**

The three memory allocation algorithms (in the scheme of dynamic partitioning placement) are:
First-Fit – in the linked list of available memory addresses, we place the data in the first entry that will fit its data. Its aim is to minimise the amount of searching, but leads to external fragmentation later on.
Worst-Fit – traverses the memory and gives the partitions as large spaces as possible – to leave usable fragments left over. Needs to search the complete list and such is a poor performer
Best-Fit – carefully scours the memory for spaces that perfectly fit the RAM we want. However, the search is likely to take a very long time.

END OF THE EXAM.