King Saud University

College of Computer and Information Sciences
Computer Science Department

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

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

Instructions:

• This exam has 8 pages. • Do not use pencil.

• Write clearly and neatly

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;		
X	b) Analyze a problem, and identify and define the computing requirements appropriate to its solution	Q.1-Q.2-Q.4	75%
X	c) Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;	Q.3	25%
X	d) Function effectively on teams to accomplish a common goal;		

	Full Mark	Student's Mark

Question No.1	8.0	
Question No.2	4.0	
Question No.3	4.0	
Question No.4	4.0	
Total	20	

King Saud University
College of Computer and Information Sciences
CSC 227: Operating Systems

Total Marks: 25 Time: 7:00pm – 8:30pm (90 minutes)
Fall 2015-16 Name: …….…… Midterm Exam I ID#: …… Date: 20-Oct-2015
Section#:…… or Teacher Name: ……

• .

Question 1. [6 marks] Select ONLY ONE ANSWER (the best answer). [CLO 4]
Copy your answer for question 1-1 to 1-12 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	The section that contains the global variables of a process is:		2.	The scheduler that selects which processes should be brought into the ready queue is:
a.	The text section.		a.	The long-term scheduler.
b.	The stack section.		b.	The short-term scheduler.
c.	The heap section.		c.	The medium-term scheduler.
d.	The data section.		d.	The CPU scheduler.

3.	Which of the following is NOT a reason for processes cooperation?		4.	A process that has terminated, but whose parent has not yet called wait(), is known as:
a.	Independency.		a.	Orphan process.
b.	Information sharing.		b.	Zombie process.
c.	Modularity.		c.	Terminated process.

d.	Computation Speedup.		d.	Child process

5.	In cascading termination:		6.	Which of the following queues contains a set of all processes in the system?
a.	Only children who has exceeded allocated resources are terminated.		a.	Job queue.
b.	Only children whose assigned task is no longer needed are terminated.		b.	Ready queue.
c.	All children are terminated.		c.	Device queue.
d.	Only the last created child is terminated.		d.	Waiting queue.

7.	An instruction executed atomically means:		8.	One common problem among the methods suggested for critical section problem is:
a.	It cannot be interrupted during its execution		a.	Continuous waiting
b.	It can interrupt any other instruction		b.	Busy waiting
c.	It can be executed in kernel mode		c.	Too difficult to program
d.	It can enter critical section anytime.		d.	Take long time to execute

9.	A non-preemptive kernel is:
a.	Free of critical section
b.	Free of deadlock
c.	**Free of race conditions in kernel mode**
d.	Free of starvation

11.	One solution to critical section problem in uniprocessor machine is:
a.	**Disabling interrupts**
b.	Enabling interrupts
c.	Using machine language instructions instead of semaphores
d.	Using `set_and_test` instruction

13.	Which are possible techniques of handling signals in the context of a multi-threaded process
a.	The system delivers the signal to the thread to which the signal applies
b.	The system, deliver the signal to every thread in the process
c.	A specific thread is assigned to receive all signals for the process

d.	**All the above**

15.	Asynchronous thread cancellation is,
a.	The activity of synchronization between two running threads that share data.
b.	When one thread runs and the other remains in hot standby mode, in case it is needed.
c.	**Thread is allowed to terminate another thread immediately without waiting.**
d.	A thread remains in waiting mode until the other thread terminates, then it receives it results and continues execution.

10.	A preemptive kernel:
a.	Does not allow preemption of process when running in kernel mode
b.	**Allows multiprocessing**
c.	Does not allow multiprocessing
d.	Allows preemption of process when running in kernel mode

12.	A thread library provides the programmer
a.	**With an API for creating and managing threads**

b.	With java program for mathematical calculations
c.	With C program for mathematical calculations
d.	With program to create user level passwords

14.	In a multithreaded process, which of these models will result in the minimum use of memory ?
a.	Two-level model
b.	**One-to-one model**
c.	Many-to-one model
d.	Many-to-many model

16.	In deferred thread cancellation, when a thread receives a cancellation request,
a.	It is allowed to wait until the current I/O is finished
b.	The thread is allowed to terminate after it closes all the opened files
c.	The thread is allowed to terminate itself immediately and close everything at once
d.	**Thread is allowed to continue running until it reaches a cancellation point and terminate itself in an orderly fashion**

1.	2.	3.	4.	5.	6.	7.	8.

9.	10.	11.	12.	13.	14.	15.	16.

Question 2. [4 marks] [CLO 5]

2-a) [1 marks] Fill in the FOUR blanks in the following process state diagram.

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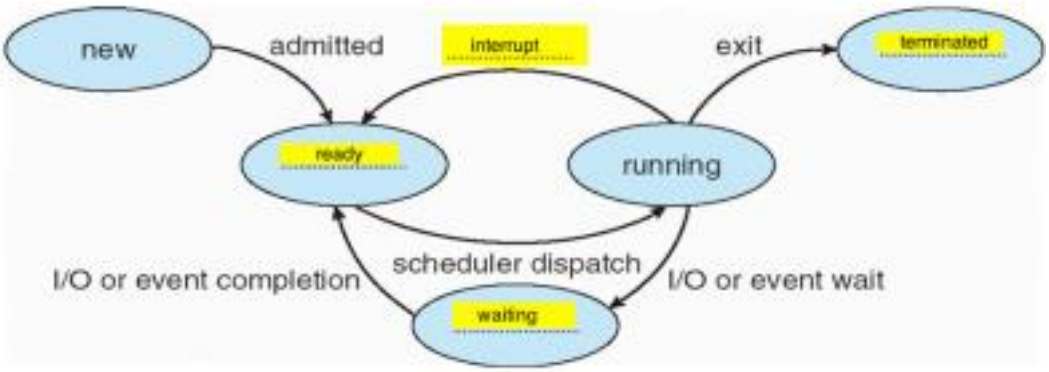
Answer:



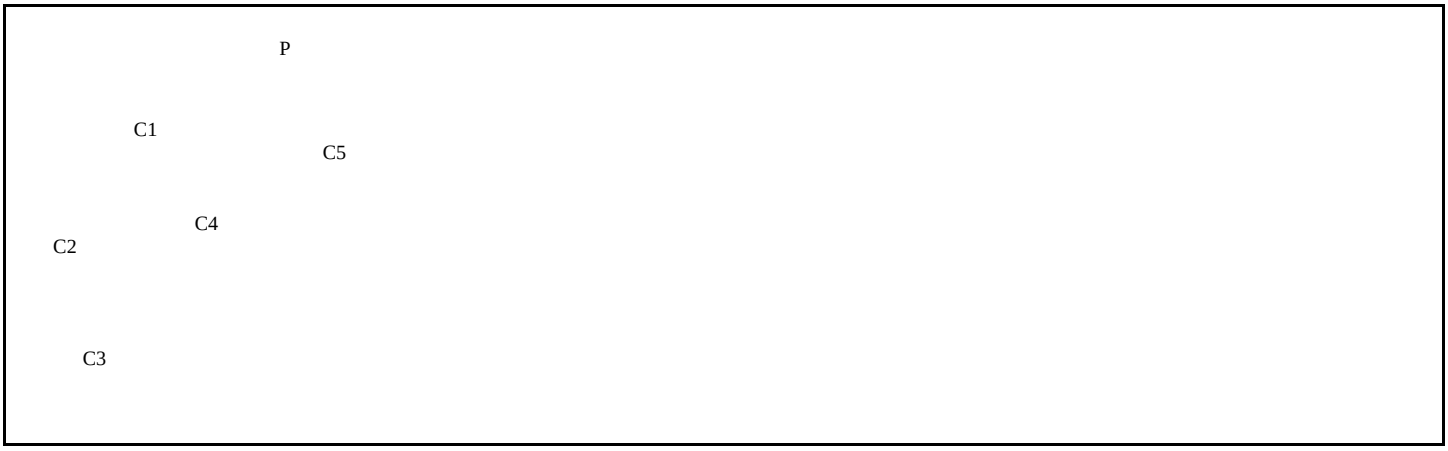
2-b) [3 marks] Consider the following C program: [CLO ??]

```
1   #include <stdio.h>
2   int num;
3   int main(){
4         num = 10;
5         if (fork() > 0) {
6               num = num * 2;
7               wait(NULL);
8               printf ("num= %d\n", num);
9         } else {
10              num = num + 5;
11              printf("num= %d\n", num);
12              fork();
13              num++;
14              printf("num= %d\n", num);
15        }
17        fork();
18  }
```

I. [1 mark] How many processes will be created by this program including the parent process?

. . . 6 processes . . . . . .

II. [1 mark] Draw the process tree resulting from this program:



III. [1 mark] What is the output of this program?

num= 15
num= 16
num= 16
num= 20

Question 3. [4 marks] [CLO 7

3-a) [0.5 marks] What is the critical section problem?

. . . . . Critical section problem is to design protocol to solve concurrent access to shared data among various processes.

3-b) [1.5 marks] List the requirements that a solution to the critical section problem must satisfy.

1) Mutual exclusion.
2) Progress.
3) Bounded waiting.

3-c) [2 marks] What is starvation? What causes it??

A process may never be removed from the semaphore queue in which it is suspended.

Causes: Deadlock, or LIFO semaphore queue where the rate of wait is higher than signal.

Question 4. [4 marks] [CLO 4]

4-a) [2 marks] Let us consider a process composed of the following CPU bursts and IO bursts:

N◦	Activity	Duration (milliseconds)		
		CPU	Waiting I/O	Total
1	Starting and initialization	5	10	15
2	Reading Data from a Network	15	20	35
3	Processing Data	50	0	50
4	Saving results to a file	25	15	40
5	Terminating	10	0	10
	Total execution time	105	45	150

1- [0.5 mark] If you want to speed-up this process using multi-threading, which task will you select to implement multi-threading? Why? …….

The task 3, because it is the largest task in terms of CPU activity, and is the one that can give the best time saving.

2- [1 mark] Considering that the system has 2 cores and that only one task can be split into 2 threads, what is the best speedup we can obtain for this process? …….

S = 100/150 = 2/3, P = 50/150 = 1/3

=

 = 1.2

3- [0.5 mark] After implementing multi-threading, what will be the best total execution time of this process, from start to the termination. …….

= 150 / 1.2 = 125 ms

4-b) [1 mark] The threads of a same process share part of the process resources. Which resources are different for each thread:

- Registers
- Stack

4-c) [1 mark] The multi-threading model one-to-one has the advantage of offering a high independence to user threads. What are its disadvantages?

Creating a kernel thread of each user thread takes time
Creating a kernel thread of each user thread uses a lot of memory