King Saud University College of Computer and Information Sciences Computer Science Department					
		Course Code:	CS	SC 227	
		Course Title:	Operati	ng Systems	
		Semester:	Spring	g-2015-16	
		Exercises Cover Sheet:	Midter	rm2-Exam	
		Dui	ation: 90 minutes		
Stu	dent Name:				
St	udent ID:				
Studer	nt Section No.				
Note	e: Shaded cells in	the table below should be up needed.	dated by the instructo	or of the course	e as
Computer Science B.Sc. Program:QuestionNCAAA: Intended Learning Outcomes (ILO) Student OutcomesNo.Relevant IsRelevant IsABET: Program Learning Outcomes (PLO) Student outcomesHyperlinke			Question No. Relevant Is Hyperlinke d	Coverin g %	
NCAA A	AA1. Knowledge (NCAAA) Suggested verbs (list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write) $\sum ABE$			$\sum ABET$	
ABET	a. Apply knowledge of computing and manematics appropriate to the discipline; (a) the discipline; (e) Understanding of professional, ethical, legal, security, and social issues and responsibilities; (a) issues and responsibilities; (i) Use current techniques, skills, and tools necessary for computing practices; (j) Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices; (k) Apply design and development principles in the construction of software systems of varying complexity;				
NCAA A ABET	2. Cognitive Skills (NCAAA) Suggested verbs (estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise) b. Ability to analyze a problem, and identify and define the computing requirements appropriate to its solution. c. An ability to design, implement and evaluate a computer-based				
ABEI	system, process g. An ability to individuals, org	, component, or program to mee analyze the local and global imp anizations and society.	t desired needs.		

	h. Recognition of the need for, and an ability to engage in,	
	continuing professional development.	
	3. Interpersonal Skills & Responsibility (NCAAA)	
NCAA	Suggested verbs (demonstrate, judge, choose, illustrate, modify,	\sum_{ARFT}
Α	show, use, appraise, evaluate, justify, analyze, question, and	
	write)	
	d. Ability to function effectively on teams to accomplish a common	
ADET	goal.	
ADLI	e. Understanding of professional, ethical, legal, security, and social	
	issues and responsibilities.	
	4. Communication, Information Technology, Numerical	
	(NCAAA)	\sum_{ABET}
	Suggested verbs (demonstrate, calculate, illustrate, interpret,	
A	research, question, operate, appraise, evaluate, assess, and	
	criticize)	
ABET	f. An ability to communicate effectively with a range of audiences.	
	5. Psychomotor (NCAAA)	
	Suggested verbs (demonstrate, show, illustrate, perform,	
	dramatize, employ, manipulate, operate, prepare, produce,	
А	draw, diagram, examine, construct, assemble, experiment, and	
	reconstruct)	

	King Saud University
	College of Computer and Information Sciences
	CSC 227: Operating Systems
Total Marks: 20	Time: 6:30pm – 8:00pm (90 minutes)
Spring 2015-16	Name:
Midterm Exam II	ID#:
Date: 02-May-2016	Section#: or Teacher Name:
Instructions:	

- This exam has 11 pages including the title page and the back page.
- Do not use pencil.
- Write clearly and neatly.

Question 1. [6 marks] Select ONLY ONE ANSWER (the best answer).

<u>Copy your answer for question 1-1 to 1-12 in the table on page2. ONLY THAT TABLE WILL BE</u> <u>GRADED.</u>

	Which of the following components of a
1.	program state IS NOT shared across threads in
	a multithreaded process?
a.	Register values
b.	Heap memory
c.	Global variables
d.	Files

3.	In a multi-threaded process, a signal IS NOT delivered to:	
a.	Every thread in the process.	
b.	Certain threads in the process.	
с.	Parent process.	
d.	The thread to which the signal applies.	

5.	A good solution of the critical section problem requires three conditions. They are:
9	Mutual inclusion, No waiting, Real-Time
а.	execution.
h	Bounded-exclusion, Real-Time waiting,
υ.	progress.
C	Progress, Mutual exclusion, bounded
С.	waiting
d	No exclusion, virtual-Time, continuous
u.	progress.

7.	Which one is not a solution the critical-section problem?
a.	Test and Set Lock
b.	Shared memory
c.	Monitor

2.	In a multithreaded process, which of these models will make the whole process to block if a thread makes a blocking system call
a.	Two-level model
b.	One-to-one model
c.	Many-to-one model
d.	Many-to-many model

4.	Which one of these operations is not necessarily a critical section?	
а	Changing a common variable	
и.		
b.	Opening a file on the disk	
с.	Writing in a database	
d.	Modifying a shared memory.	

6.	To make a code execute without preemption in uniprocessor system (only 1 processor), it is possible to:
a.	Disable interrupts
b.	Use only atomic operations
c.	Use only kernel mode
d.	Enable interrupts

8.	Dispatch latency is the time it takes:	
a.	For the dispatcher to stop one process and start another running	
b.	To finish the quantum	
c.	To change scheduling algorithm	

d. To start bootsrap program

9.	Bounded waiting implies that there exists a bound on the number of times a process is allowed to enter its critical section:	10.	Which one is a hardware solution to the critical- section problem?
a.	After a process has made a request to enter its critical section and before the request is granted	a.	Test and Set Lock
b.	When another process is in its critical section	b.	Shared memory
c.	Before a process has made a request to enter its critical section	с.	Semaphore
d.	None of the above	d.	Monitor

		_				
	12.	In round robin algorithm, small quantum results in:				
s from	a.	Context switching overhead				
	b.	Makes it work like FCFS				
	с.	Makes it look like SJF				
erating	d. Starvation					
5.	6.		7.	8.	9.	10.

11.	CPU	CPU scheduling					in:				
a.	Is the selection of multiple processes from ready queue						Context switching overhead				
b.	. Is the basis for multiprocessor systems					b.	Makes it work like FCFS				
c.	Is the basis for multi-server systems.					с.	Makes it look like SJF				
d.	Is the basis for multi-programmed operating systems					d.	Starvation				
1	l.	2.	3.	4.	5.	6.		7.	8.	9.	10.
1	1.	12.]								

Question 2. [3.5 marks]

2-a) [1 mark] Why should a web server not run as a single-threaded process?

Answer

For a web server that runs as a single-threaded process, only one client can be serviced at a time. This could result in potentially enormous waiting times for a busy server.

2-b) [1 mark] Multicore systems present certain challenges for multithreaded programming. Give two of these challenges.

Answer Dividing activities Balance Data splitting Data dependency Testing and debugging

2-c) [1 mark] What are the two methods for thread cancellation?
Answer
Asynchronous cancellation and deferred cancellation.

2-d) [0.5 mark] Write down one information that will be in the process control block (PCB) and not in a thread control block (TCB)

Answer

PID, process state, memory management information, program counter, etc.

Question 3. [3.5 marks]

3-a) [1.0 mark] A good solution of the critical section problem requires three conditions. One of them is "Bounded Waiting". What is the meaning of "Bounded waiting" in a critical-section solution? [1 mark]

A bound must exist on the number of times that other processes are allowed to enter their critical sections after a process has made a request to enter its critical section and before that request is granted. This should assume that each process executes at a nonzero speed and no assumption concerning relative speed of the n processes.

3-b) [1.0 mark] The kernel code can be non-preemptive.

- i) What does it mean exactly? [0.5 mark]
 Non-preemptive means that it cannot be interrupted.
- ii) If the kernel code is non-preemptive, in which conditions it can stop running? [1 mark]
 It will run until it exits kernel mode (1), or until it blocks (2), or until it voluntarily yields CPU (3).

3-c) [1.5 marks] Considering the producer-consumer problem and considering the code below running on a multi-processor system, what is the problem with this code? Explain

The following are shared between the two processes:					
Buffer[], counter and BUFFER_SIZE.					
while (true) {/*produce 1 item	while (true) {				
in next_produced */	while (counter == 0)				
while (counter == BUFFER_SIZE)	; /* do nothing */				
; /* do nothing */	<pre>next consumed = buffer[out];</pre>				
<pre>buffer[in] = next_produced;</pre>	out = (out + 1) % BUFFER_SIZE;				
in = (in + 1) % BUFFER_SIZE;	counter;				
counter++;	/* consume the item in				
}	next consumed */				
	}				

The problem is that counter++ and counter-- can be implemented as 3 different operation and thus their execution may be interleaved and cause a wrong result.

Question 4. [3.5 marks]

4-a) [1.5 marks] Many systems provide hardware support for implementing the critical section code based on idea of locking:



However, using such **acquire lock** and **release lock** protections for the critical section, may give the chance to the currently running code to be executed without preemption, such scenario is generally too inefficient on multiprocessor systems and operating systems using this not broadly scalable.

Modern machines provide special atomic hardware instructions such as: test memory word and set value. A Boolean test and set instruction is defined as follows:

```
Definition:
    boolean test_and_set (boolean *target)
    {
        boolean rv = *target;
        *target = TRUE;
        return rv:
    }
```

Give a Solution to the critical section problem using the special atomic hardware instruction test_and_set(). [1.5 Marks].

```
do {
		while (test_and_set(&lock))
		; /* do nothing */
		/* critical section */
		lock = false;
		/* remainder section */
	} while (true);
```

4-b) [2.0 marks] Semaphore is a synchronization tool that provides sophisticated ways for processes to synchronize their activities. A Semaphore **S** is an integer variable which can only be accessed via two indivisible (atomic) operations **wait()** and **signal()**.

Give the de definition of both operations wait() and signal().

Answer: Definition of the wait() operation

Definition of the signal() operation signal(S) { S++; }

Question 5. [3.5 marks]

5-a) [1.0 marks] Differentiate between process contention (PCS) scope and system contention scope (SCS).
PCS: Scheduling competition is within the process
SCS: Competition among all threads in system.

5-b) [1.5 marks] Under what situations, CPU scheduling decisions may take place?

Switches from running to waiting state Switches from running to ready state Switches from waiting to ready Terminates

5-c) [1.0 marks] Differentiate between turnaround time and response time.

Turnaround time: amount of time to execute a particular process

Response time: amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)

	RESULTS					
Note	e: Shaded cells in the table below should be updated	by the instr	uctor of t	he cours	e as	
needed.						
Tick the Releva nt	Computer Science B.Sc. Program: NCAAA: Intended Learning Outcomes (ILO) Student Outcomes ABET: Program Learning Outcomes (PLO) Student outcomes	Question No. Relevant Is Hyperlin ked	Cover ing %	Full Mark	Stude nt Mark	
NCAA A	1. Knowledge (NCAAA) Suggested verbs (list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write)	Exercie1- 5	$\sum ABE$			
	(a)	Exercise 1	5%			
ABET	(e)	Exercise2	10%			
ADEI	(i)	Exercise3	5%			
	(j)	Exercise4	10%			
		Exercise5	5%			
NCAA A	2. Cognitive Skins (IVCAAA) Suggested verbs (estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise)	Exercise6 -9	$\sum ABE$			
	(a)	Exercise6	5%			
ABET	(b) (g)	Exercise7	5%			
	(g) (h)	Exercise0	10%			
ΝΟΛΛ	(1) 3 Internersonal Skills & Responsibility	Exercise1				
A	(NCAAA)	0-11	$\sum ABE$			
ABET	d. Ability to function effectively on teams to accomplish a common goal.	Exercise1 0	5%			
	e. Understanding of professional, ethical, legal, security, and social issues and responsibilities.	Exercise1 1	15%			
NCAA A	4. Communication, Information Technology, Numerical (NCAAA)	Exercise1	$\sum ABE$			
ABET	f. An ability to communicate effectively with a	Exercise1	15%			
	range of audiences.	2				
NCAA A	5. Psychomotor (NCAAA)	Exercise1	5%			
	Feedback and Remarks	•				

Leastify that the work contained within this	Foodbook Doppiyed
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