جامعة الملك سعود King Saud University	King Saud University College of Computer and Information Sciences Computer Science Department
Course Code	CSC 227
Course Title	Operating Systems
Semester	Spring 2019
Type of Examination	Midterm 2 Exam
Student Name:	
Student ID:	
Student Section No.	
Instructor Name:	

	Full Mark	**Student's Mark**
Question No.1	8	
Question No.2	3	
Question No.3	4	
Question No.4	5	
Total	20	

Instructions:

- This exam has 20 marks.
- This exam has 6 pages
- **Do not use pencil.**
- Write clearly and neatly.
- Copy your answers for questions 1-1 to 1-16 in the table below. **ONLY THAT TABLE WILL BE GRADED**

1.	2.	3.	4.	5.	6.	7.	8.
D	C	B	B	C	D	A	D
9.	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**
C	A	A	B	A	B	A	D

Question 1. [8 marks] Select ONLY ONE ANSWER (the best answer).

1.	Kernels generally are
a.	Single threaded
b.	Single threaded by default, but require user intervention to be multithreaded
c.	Multithreaded but limited to available number of cores
d.	Multithreaded

2.	The following are shared among threads
a.	Global variables, local variables, opened files
b.	Registers, stack, global variables
c.	Global variables, opened files, and code
d.	Data, opened files, stack

3.	Testing and debugging is (a) _____ for (b) _____
a.	(a) The same. (b)single threaded and multithreaded applications
b.	(a) a challenge (b) multithreaded applications
c.	(a) not a challenge (b) multithreaded applications
d.	(a) not required (b)multithreaded applications

4.	A server for a multiplayer game requires
a.	Single threaded application to control requests from users
b.	Multithreaded application to control requests from users
c.	No server required, connection of minds would materialize the multiplayer game
d.	Each player will be connected to a process in the server with a different code.

5.	Thread switching has _____ overhead in comparison to context switching
a.	The same
b.	Greater
c.	Lower
d.	None of the Above

6.	_____ provides programmer with API for creating and managing threads
a.	System library
b.	User program
c.	System calls
d.	Thread libraries

7.	_____ selects which processes should be brought into the ready queue.
a.	Long-term scheduler
b.	Short-term scheduler
c.	Medium-term scheduler
d.	Dispatcher

8.	When the degree of multiprogramming needs to be decreased, the following scheduler is used:
a.	Job Scheduler
b.	Long-term scheduler
c.	Short-term scheduler
d.	Medium-term scheduler

9.	_____ is a system call used to replace a process' memory space with a new program.

10.	What state would a process be in after an interrupt?

a.	fork( )
b.	replace( )
c.	exec( )
d.	wait( )

a.	Ready
b.	Waiting
c.	Interrupted
d.	Running

11.	The _____ section of a process contains dynamically allocated memory during run time.
a.	Heap
b.	Stack
c.	Data
d.	Text

12.	Context switching time depends heavily on:
a.	Hardware support via larger RAM
b.	Hardware support via multiple sets of registers per CPU
c.	OS support via more complex PCB
d.	None of the above.

13.	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

14.	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

15.	In priority scheduling algorithm,
a.	CPU is allocated to the process with highest priority mentioned
b.	CPU is allocated to the process with lowest priority
c.	Equal priority processes cannot be scheduled
d.	Both A and B

16.	Process are classified into different groups in:
a.	Shortest job scheduling algorithm
b.	Round robin scheduling algorithm
c.	Priority scheduling algorithm
d.	Multilevel queue scheduling algorithm

Question 2. [3 marks]

2-a) [1 mark] Explain Data parallelism with an example?

Data parallelism – distributes subsets of the same data across multiple cores, same operation on each

Any example that divide the data and perform the same operation would be acceptable. [1 mark]

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2-b) [1 mark] Calculate the performance gain for an application that is 100% serial in case of switching from dual core processer to quad core?

$$speedup \leq \frac{1}{S + \frac{(1-S)}{N}}$$

Since the application is 100% serial , the speedup would be <= 1/1 regardless of the number of cores. So there are NO performance gain by switching from dual core to quad core.

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2-c) [1 mark] List four benefits of multithreaded programming.

Each correct answer (0.25)

Responsiveness – may allow continued execution if part of process is blocked, especially important for user interfaces

Resource Sharing – threads share resources of process, easier than shared memory or message passing

Economy – cheaper than process creation, thread switching lower overhead than context switching

Scalability – process can take advantage of multiprocessor architectures

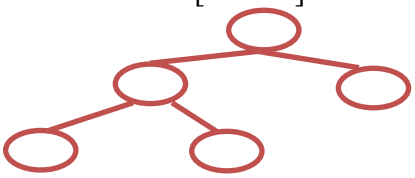
Question 3. [4 marks]

3-a) [2 marks] For the following C code, what's the output of this program? Also, draw the process tree.

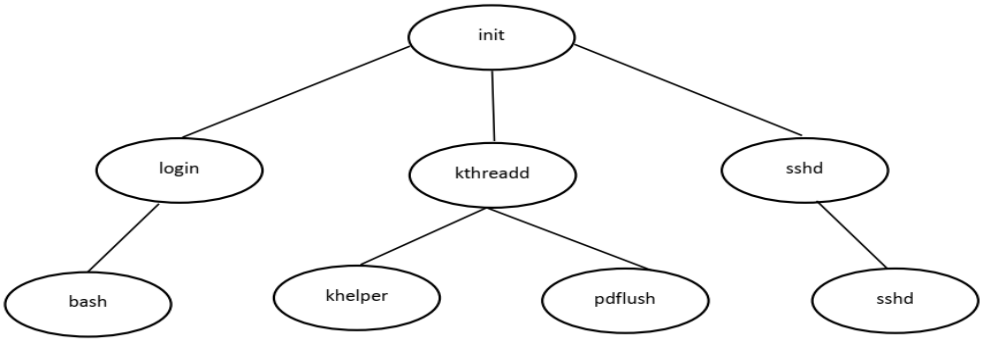
```
#include <stdio.h>
#include <unistd.h>
int main() {
    if (fork()>0 || fork()>0)
        fork();
    printf("1 ");
    return 0;
}
```

Output [1 mark]: 1 1 1 1 1

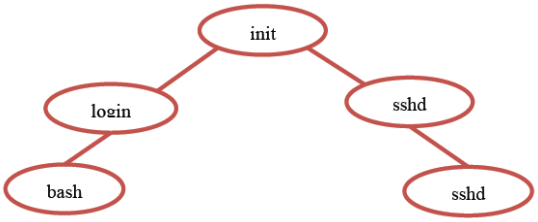
Process Tree [1 mark]:



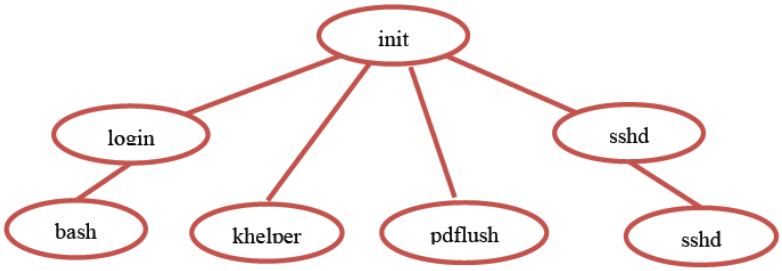
[2 marks] Consider the following process tree:



1- Draw the process tree after **`kthreadd`** terminates assuming cascading termination is enabled.



2- Draw the process tree after **`kthreadd`** terminates assuming cascading termination is NOT enabled.



Question 4. [5 marks]

Consider the following set of processes which are assumed to have arrived in the order P1, P2, P3, P4 all at time **zero**.

Process	Burst Time	Waiting Time
P1	3	……0……..
P2	5	……3……..
P3	11	……8……..
P4	2	……19……..

4-a) [2 marks] Calculate waiting time for each process using FCFS scheduling algorithm.

4-b) [1 mark] Calculate the average waiting time for the above scenario.

Average waiting time = (0+3+8+19) / 4 = 7.5

[1 marks] Draw the Gantt chart of the following scenario given in table below using the Shortest Remaining Time First (preemptive version of the shortest job first) algorithm:

Process	Arrival Time	Burst Time	Turnaround Time
P1	0	6	6
P2	3	4	9
P3	4	2	4
P4	5	7	14

4-c) [1 marks] Calculate the turnaround time for each process using SRTF scheduling algorithm.