King Saud University
College Of Computer and Information Sciences
Computer Science Department
CSC 227: Operating Systems

Total Marks: 25 **Time: 6:30pm – 8:00pm (90 minutes)**
Spring 2015-16 **Name:** ……
Midterm Exam I **ID#:** ……
Date: 8-March-2016 **Section#:**…… **or Teacher Name**: ……

Question 1. [10 marks] Select ONLY ONE ANSWER (the best answer).
Copy your answer for question 1-1 to 1-15 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	The user and kernel modes define ……..
a.	client mode of operation
b.	dual-mode of operation
d.	**symmetric mode of operation**
f.	non symmetric mode of operation

2.	……. implies that a computer is simultaneously running two or more programs at the same time
a.	client
c.	**multi-tasking**
e.	multicore
g.	multi-processors

3.	Storage systems are organized in ……
a.	**Speed, cost, volatility**
b.	Speed, cost, size
d.	Volatility, cost, technology
f.	Cost, size, usage

4.	……. specifies the address of next instruction to execute.
a.	loop
c.	timer
e.	**program counter**
g.	instruction register

5.	Setting up of a timer to avoid infinite loop is done at …….
a.	user level
b.	**kernel level**
c.	application level
d.	hardware level

6.	OS determines the status of a device by …….
a.	**devices status table**
b.	interrupt
c.	register
d.	cpu

7.	The four components of a computer system are ……..
a.	hardware, operating system, application programs and network
b.	**hardware, operating system, application programs and users**
c.	**hardware, system call, application programs and users**
d.	hardware, operating system, application programs and i/o

8.	Program that initializes all aspects of the system, from CPU registers to device controller and memory is called
a.	software
b.	application program
c.	middleware
d.	**bootstrap**

9.	Multiplexing the CPU among many process is a way of achieving …….
a.	**concurrency**
b.	efficiency
c.	speed
d.	volatility

10.	When an interrupt occurs, ……. is used to get address of interrupt service routine.
a.	memory
b.	hardware
c.	**interrupt vector**
d.	operating system

11.	Operating systems provide an environment for:
a.	execution of programs only.
b.	execution of services to programs only.
c.	**execution of programs and services to programs and users.**
d.	none of the above.

12.	Almost all operating systems have a User interface (UI) that may be:
a.	command-line interface (CLI).
b.	graphics user interface (GUI).
c.	batch
d.	**all the above.**

13.	One set of operating-system services provides functions that are helpful to the user:
a.	read and write files and directories.
b.	exchange information between processes
c.	for each type of error, os should take the appropriate action
d.	**all the above.**

14.	A method used to pass parameters to the OS:
a.	pass the parameters in registers
b.	store parameters in a block, or table, in memory
c.	place parameters, or pushed, onto the stack by the program and popped off the stack by the operating system
d.	**all of the above.**

15.	In the design and implementation of an operating system:
a.	**mechanisms and policies are not considered as different concepts.**
b.	mechanisms and policies have the same concepts.
c.	mechanisms determine how to do something, policies decide what will be done.
d.	all the above.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

11.	12.	13.	14.	15.

16.Answer following statement using True (T) or False (F):

Statement	Answer
a. CLI or command interpreter allows direct command entry	**T**
b. Application Programming Interface is a programming interface to the services provided by the OS	**F**
c. When power initialized on system, execution starts at a fixed memory location in RAM used to hold initial boot code	**T**
d. Many modern operating systems implement loadable kernel modules	**T**
e. Internal structure of different operating systems are same	**F**

Question 2. [5 marks]

1-a) [1 mark] What happens when a user executes a system call such as read_file()?

Parameters passed to read() are as follows:

`int fd` //the file descriptor to be read

`void *buf` //a buffer where the data will be read into

`size t count` //the maximum number of bytes to be read into the buffer

On a successful read, the number of bytes read is returned. A return value of 0 indicates end of file. If an error occurs, read() returns −1.

1-b) [1 mark (0.5+0.5)] What are the two modes of inter-process communication? What are the strengths and weaknesses of the two approaches?

Processes may exchange information, on the same computer or between computers over a network

Communications may be via shared memory or through message passing (packets moved by the OS).

Message passing is useful for exchanging smaller amounts of data, because no conflicts need be avoided. It is also easier to implement than is shared memory for inter-computer communication. Shared memory allows maximum speed and convenience of communication, since it can be done at memory transfer speeds when it takes place within a computer. Problems exist, however, in the areas of protection and synchronization between the processes sharing memory.

1-c) [1 mark] What is the main feature of a microkernel?

Microkernel is small.

1-d) [1 mark] What are the advantages of using loadable kernel modules?

Uses object-oriented approach

Each core component is separate

Each talks to the others over known interfaces

Each is loadable as needed within the kernel

More flexible than a layered system, because any module can call any other module.

1-e) [1 mark] What is the function of SYSGEN utility?

SYSGEN program obtains information concerning the specific configuration of the hardware system

Used to build system-specific compiled kernel or system-tuned.

Question 3. [5 marks]

Below is the traditional UNIX System Structure with a list of its layers' contents.
You are asked to recognize the name and content of each layer, using its corresponding sequential number in the table of names, then put it on the structure in Figure 1.

<table>
<tr><td colspan="3">The users
(4)</td></tr>
<tr><td colspan="3">Shell and commands
Compiles and Interpreters
System libraries
(3)</td></tr>
<tr><td colspan="3">System-call interface to the kernel
(10)</td></tr>
<tr><td>Signal terminal handling
Character I/O system
Terminal drivers
(9)</td><td>File system
Swapping block I/O system
Disk and tape drivers
(2)</td><td>CPU scheduling
Page replacement
Demand paging
Virtual memory
(5)</td></tr>
<tr><td colspan="3">Kernel interface to the hardware
(8)</td></tr>
<tr><td>Terminal controllers
Terminals
(1)</td><td>Device controllers
Disks and tapes
(6)</td><td>Memory controllers
Physical memory
(7)</td></tr>
</table>

Figure 1. UNIX System Structure

1	Terminal controllers Terminals
2	File system Swapping block I/O system Disk and tape drivers
3	Shell and commands Compiles and Interpreters System libraries
4	The users
5	CPU scheduling Page replacement Demand paging Virtual memory
6	Device controllers Disks and tapes
7	Memory controllers Physical memory
8	Kernel interface to the hardware
9	Signal terminal handling Character I/O system Terminal drivers
10	System-call interface to the kernel

Question 4. [5marks]
2-a) [1 mark] How does caching help in improving the performance of a computer?

In caching information in use copied from slower to faster storage temporarily. When we need a particular piece of information, we first check whether it is in the cache. If it is, we use the information directly from the cache which is faster memory.

2-b) [1 mark (0.5+0.5)] What is the difference between symmetric and asymmetric multiprocessor systems?
Asymmetric Multiprocessing – each processor is assigned a specie task.
Symmetric Multiprocessing – each processor performs all tasks

2-c) [1 mark (0.5+0.5)] What are the differences between a trap and an interrupt? What is the use of each function?
An interrupt is a hardware-generated signal that changes the flow within the system. A trap is a software-generated interrupt.
An interrupt can be used to signal the completion of I/O so that the CPU doesn't have to spend cycles polling the device. A trap can be used to catch arithmetic errors or to call system routines.

2-d) [1 mark] Why is DMA preferred method of accessing fast devices like disk? Explain.
Allows transmit information at close to memory speeds for high speed devices. Data is transferred directly to memory without CPU intervention. Only one interrupt is generated per block, rather than the one interrupt per byte.

2-e) [1 mark (0.5+0.5)] What is dual-mode? Why is it used?
A means of protection to ensure proper execution of operating system. This protection is achieved by marking some instructions as privileged and not allowing them to execute in user mode.