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	Winter 2022-2023 (II)	
Type of Examination	Midterm Exam	**Duration:** 2.0hrs
Student Name:		
Student ID:		
Student Section No.		
Instructor Name:		

	Full Mark	**Student's Mark**
Question No.1	9	
Question No.2	7	
Question No.3	7	
Question No.4	7	
Total	30	

Instructions:

- This exam has 30 marks.
- This exam has 7 pages.
- **Do not use pencil.**
- No partial credit.
- Write clearly and neatly.
- Copy your answers in the tables below. **ONLY THAT TABLES WILL BE GRADED**

Please copy your answers for **Question 1** here.

1.1	1.2	1.3	1.4	1.5
1.6	**1.7**	**1.8**	**1.9**	

Please copy your answers for **Question 2** here.

2.A.1	2.A.2	2.A.3	2.A.4	2.A.5	2.A.6
2.B.1	**2.B.2**	**2.B.3**	**2.B.4**	**2.B.5**	**2.B.6**
	2.B.7			**2.B.8**	

Please copy your answers for **Question 3** here.

3.1	3.2	3.3	3.4	3.5.A	3.5.B
Ready	Short-term	CPU-bound	interrupted	Message passing	shared memory
3.6.A	**3.6.B**	**3.7**	**3.8**	**3.9**	**3.10**
Fork()	Exec()	Program counter	Swapping	PCB	Context switching
3.11.A	**3.11.B**				
2	value=16 value=1				

Please copy your answers for **Question 4** here.

4.A.1	4.A.2	4.A.3	4.A.4	4.A.5	4.A.6	4.A.7	4.A.8
4.B.1	**4.B.2**	**4.B.3**	**4.B.4**	**4.B.5**	**4.B.6**	**4.B.7**	**4.B.8**

Question 1. [9 Marks]

Fill the blanks:

Q 1.1 Mode bit provided by hardware provides ability to distinguish when system is running user code or kernel code

Q 1.2 Multiprocessor environment must provide cache coherency in hardware such that all CPUs have the most recent value in their cache

Q 1.3 Protection is any mechanism for controlling access of processes or users to resources defined by the OS while Security is defense of the system against internal and external attacks

Q 1.4 Emulation used when source CPU type different from target type, while in Virtualization OS natively compiled for CPU, running guest OSes also natively compiled.

Q 1.5 (Virtual memory) allows execution of processes not completely in memory

Q 1.6 (System call) is used to request for operating system service.

Q 1.7 (Kernel) is the program that runs all times on the computer.

Q 1.8 On occurrence of an interrupt transfer of control to the interrupt service routine through the (interrupt vector).

Q 1.9 (Bootstrap) program is loaded at power-up or reboot initializes operating system kernel and starts execution.

Question 2. [7 Marks]

Part A Select ONLY ONE ANSWER (the best answer) [3 Marks]

1) In microkernel communication takes place between user modules using ----------
a) Bus
b) Shared memory
c) System call
d) Message passing

2) Arduino was designed as:
a) Single Tasking OS with a Single Memory space
b) A microkernel OS
c) A Layered System
d) Modular system

3) It is among the general methods used to pass parameters to the OS.
a) Pass the parameters in registers
b) Parameters stored in a block, or table, in memory, and address of block passed as a parameter in a register
c) Parameters pushed onto the stack by the program and popped off the stack by the operating system
d) All the above

4) Which system structure the different OS modules are loadable on need basis into the kernel?
a) Microkernel system structure
b) Modular system structure
c) Layered System structure
d) Monolithic system structure

5) When power initialized on system, execution starts at a fixed memory location through
a) Small piece of code -Bootstrap loader or BIOS.
b) Unified Extensible Firmware Interface (UEFI).
c) A & B
d) None of the above

6) ……allows selection of kernel from multiple disks, versions, kernel options
a) Firmware
b) Arduino
c) GRUB
d) Boot Block

Part B [4 Marks]

Fill the blanks:

1) One of the common Operating System structures are the Layered Approach, it can be described
   as …Answer.2.B.1…….....
Answer: The operating system is divided into a number of layers (levels), each built on top of lower layers. The bottom layer (layer 0), is the hardware; the highest (layer N) is the user interface.

2) With modularity, layers are selected such that each uses functions (operations) and services of only …Answer.2.B.2……layers.

   Answer: lower-level

3) Two major difficulties when Layered approach is applied [1 Mark] are ……Answer.2.B.3 and …Answer.2.B.4

Answer:
- Layers need to be carefully defined [0.5 mark]
- They tend to be less efficient than other types. [0.5 mark]

4) Operating System provides various services to programs and users, or to ensure efficient operation of the system, list at least four provided services? [2 Marks]
   Answer:
   (1) Answer 2.B.5
   (2) Answer 2.B.6
   (3) Answer 2.B.7
   (4) Answer 2.B.8

Possible answers:
- User interface -
- Program execution
- File-system manipulation - The file system is of particular interest. Programs need to read and write files and directories, create and delete them, search them, list file Information, permission management.
- Communications
- Error detection –
- Resource allocation
- Logging
- Protection and security

Question 3. [7 Marks]

Fill in the blanks:

3.1 On a typical OS, most of the processes are in ….Answer 3.1…. state.

3.2 The ….Answer 3.2…. scheduler selects which processes should be brought into the ready queue.

3.3 A …… Answer 3.3…… process spends more of its time doing computational work than seeking I/O operations.

3.4 The state transition from running state to ready state happens when a process …. Answer 3.4….

3.5 The two models of inter-process communication are …. Answer 3.5.A…. and …. Answer 3.5.B….

3.6 …. Answer 3.6.A…. system call creates a new process and …. Answer 3.6.B …. system call replaces the process' memory space with a new program.

3.7 The address of the next instruction to be executed by the current process is provided by the …. Answer 3.7….

3.8 Remove a process from memory, store on disk, bring back in from disk to continue execution is called …. Answer 3.8….

3.9 …. Answer 3.9…. is a data structure used by an operating system to manage processes.

3.10 An action performed by the OS to remove a process from the CPU and replace it with another is known as …. Answer 3.10….

3.11 Assume the following code is compiled and run on a modern Linux machine.

```
#include<sys/types.h>
#include<stdio.h>
#include<unistd.h>
int main() {
   int v=0;
   pid_t pid = fork();
   v++;
   if (pid>0) {
       wait(NULL);
       printf("value=%d\n",v);
   } else if (pid==0) {
      v+=15;
      printf("value=%d\n",v);
   }
   return 0;
}
```

Assuming fork will never fail, the total number of processes running (including the main process) is …. Answer 3.11.A…. and the output of this code is …. Answer 3.11.B…..

Question 4. (7 Marks)

Consider the following set of processes with their arrival and burst times.

Process	Arrival Time	Burst Time
P1	0	6
P2	1	4

P3	3	10
P4	5	2

4.A Calculate the turnaround time and waiting time for each process using Round Robin scheduling algorithm, given the time quantum q=2. [3.5 marks]

Process	Turnaround Time	Waiting Time
P1	Answer 4.A.1 14	Answer 4.A.2 8
P2	Answer 4.A.3 9	Answer 4.A.4 5
P3	Answer 4.A.5 19	Answer 4.A.6 9
P4	Answer 4.A.7 7	Answer 4.A.8 5

4.B Calculate the turnaround time and waiting time for each process but this time using FCFS scheduling algorithm [3.5 marks]

Process	Turnaround Time	Waiting Time
P1	Answer 4.B.1 6	Answer 4.B.2 0
P2	Answer 4.B.3 9	Answer 4.B.4 5
P3	Answer 4.B.5 17	Answer 4.B.6 7
P4	Answer 4.B.7 17	Answer 4.B.8 15