

Operating Systems (11335)
First Exam, Fall 2017/2018

November 21, 2017
Time Allowed: 60 minutes

Instructor Name: _____

Section Time: _____

Student Name: _____

Student Number:

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Question	Points	Score
1	4	
2	4	
3	4	
4	4	
5	4	
6	4	
Total	20	

Note: You have to answer Q1 and Q2.

Question 1: (4 points): Answer the following Multiple-Choice Questions

1. Multiprogramming is about:

- a) Batch processing
- b) Interactive multitasking
- c) **Sharing the CPU for more than one program**
- d) Sharing the bus by many programs

2. change in the status of a mouse is signaled to the OS by:

- a) **I/O interrupt**
- b) Software interrupt
- c) Interrupt vector
- d) Process interrupt

3. With a uniprocessor if one thread is blocked then:

- a) all other threads become active (running) at a time
- b) all other threads get blocked
- c) all other threads can access every address in the task
- d) **another thread can run**

4. Protection is:

- a) **mechanism for controlling access of processes**
- b) defense of the system against internal threats
- c) defense of the system against external threats
- d) safeguarding the system from overflow

5. With indirect communication, the messages are sent to and received from

- a) Buffers
- b) **Mailboxes**
- c) Shared memory
- d) All of the above

6. The state of a process after it encounters an I/O instruction is:

- a) Ready
- b) **Blocked / waiting**
- c) Idle
- d) Running

7. to start a new process _____ need to be performed by a command interpreter or shell

- a) an exec system call
- b) **a fork system call followed by an exec system call**
- c) an exec system call followed by a fork system call
- d) fork()

8. One of the services provided by the operating system: _____ The operating system loads the contents (or sections) of a file into memory and begins its execution.

- a) File-system manipulation
- b) **Program execution**
- c) I/O operation
- d) Both a and b

9. Swapping

- a) does not work with overlaying
- b) allows each program in turn to use the memory
- c) allows many programs to use memory simultaneously
- d) works best with many small partitions

10. In a Batch system

- a) Jobs are executed concurrently
- b) Jobs are executed immediately in an interactive mode
- c) Jobs are executed one after the other without the intervention of the user
- d) All of the above

11. CPU Utilization means:

- a) Keep the CPU as busy as possible
- b) Large number of processes waiting in the ready queue
- c) The CPU is allocated to the process with the highest priority
- d) None of above

12. Multiprogramming System

- a) Are easier to develop than single programming systems
- b) Execute each job faster
- c) Execute more jobs in the same time
- d) Are used only on large main frame computers

Question 2: (4 points)

a) Give a definition of the following terms: (2 Marks)

1. **Kernel:** The one program running at all times on the computer
2. **A trap:** A trap is a software-generated interrupt caused either by an error or a user request.
3. **DMA: Direct Memory Access** It allows transfer of blocks of data between memory and I/O device without intervention of the CPU, by making the transfers in between CPU instruction execution.
4. **System call:** request to the operating system to allow user to wait for I/O completion

b) Briefly explain why an application to benefit from a clustered system needs to be written with parallelization? (2 Marks)

Question 4: (4 points) Choose one out of the following questions (a & b)

- a) A process can be in one of the following states: ready, running, waiting, and terminated. What event will lead to the following transitions?
1. Running to ready directly
 2. Running to waiting directly
 3. Waiting to ready directly
 4. Waiting to terminated directly

Answer : 2 marks per each of 1 to 4.

1. Running to ready directly: Interrupt, time-out (end of time slice), arrival of a higher priority process, sleep system call.
 2. Running to waiting directly: Request for I/O, process forks a child, wait for an event, wait system call.
 3. Waiting to ready directly: End of I/O, parent becomes ready after child complete execution.
 4. Waiting to terminated directly: I/O error, parent is exiting, parent kills a child.
- b) Explain how a new process is created in UNIX.

Solution:

In UNIX each process is identified by its process identifier, which is a unique integer. A new process is created by the fork() system call.

The new process consists of a copy of the address space of the original process. This mechanism allows the parent process to communicate easily with its child process.

Both processes (the parent and the child) continue execution at the instruction after the fork(), with one difference: the return code for the fork() is zero for the new (child) process, whereas the (nonzero) process identifier of the child is returned to the parent

Question 5: (4 points): Answer only two questions from the following questions

- [illegible]

Question 6: (4 points): Answer only two questions from the following questions

- a) What are the major problems that face a developer when deciding to use multi-threading?
- b) Provide two programming examples in which multithreading provides better performance than a single-threaded solution.

Answer:

- 1) A Web server that services each request in a separate thread.
- 2) A parallelized application such as matrix multiplication where (different parts of the matrix may be worked on in parallel.
- 3) An interactive GUI program such as a debugger where
 - a thread is used to monitor user input
 - another thread represents the running application
 - and a third thread monitors performance.

- c) Distinguish among Multithreading models? Give an example for each?

- d) Why should a web server not run as a single-threaded process? How can this be remedied?

Solution:

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

Each time a client is accepted a new thread is spawned to handle the request while the server returns to handling new client requests.