

CS 3305: Operating Systems
Department of Computer Science
The University of Western Ontario
Sample Exam
Fall, 2019

NAME : xxxxx

STUDENT NUMBER : _____

This is a closed book exam. You have xxx minutes to complete xx questions. *Please write neatly and clearly.* You should have xx pages.

Question	Grade
1	____/xx
2	____/xx
3	____/xx
4	____/xx
5	____/xx
Total	____/100

Score : _____/ 100

Sample Multiple Choice

1. (2 points) A _____ is an example of an operating systems service.
 - a) **command line**
 - b) web browser
 - c) text formatter
 - d) database system

2. (2 points) Which of the following statements is incorrect?
 - a) An operating system provides an environment for the execution of programs.
 - b) An operating system manages system resources.
 - c) **Operating systems must provide web browsers.**
 - d) Operating systems must provide both protection and security.

3. (2 points) A process control block _____.
 - a) **includes information on the process's state**
 - b) stores the address of the next instruction to be processed by a different process
 - c) determines which process is to be executed next
 - d) is an example of a process queue

4. (2 points) When a child process is created, which of the following is not true?
 - a) The execution order of parent and child process is non-deterministic
 - b) The child process will not be able to create a child
 - c) The child is a duplicate of the parent
 - d) **All of the above**

5. (2 points) A process may transition to the Ready state by which of the following actions?
 - a) Completion of an I/O event
 - b) CPU just pre-empted a process
 - c) Newly-admitted process
 - d) **All of the above**

6. (2 points) A significant problem with priority scheduling algorithms is _____.
 - a) Complexity
 - b) **Starvation**
 - c) Determining the length of the next CPU burst
 - d) Determining the length of the time quantum

7. (2 points) The mapping of a logical address to a physical address is done by the ____.
- a) **memory-management-unit (MMU)**
 - b) memory address register
 - c) relocation register
 - d) dynamic loading register
8. (4 points) Suppose we have the following page accesses: 1 2 3 4 2 3 4 1 2 1 1 3 1 and that there are three frames within our system. Using the FIFO replacement algorithm, what will be the final configuration of the three frames following the execution of the given reference string?
- a) 4, 1, 3
 - b) 3, 1, 4
 - c) 4, 2, 3
 - d) 3, 4, 2
9. (2 points) A RAID structure ____.
- a) is primarily used for security reasons
 - b) is primarily used to ensure higher data reliability
 - c) stands for redundant arrays of inexpensive disks
 - d) is primarily used to decrease the dependence on disk drives
10. (2 points) ext2 and ext3 are part of which OS file systems?
- a) Windows
 - b) Linux
 - c) UNIX
 - d) Both b and c

Sample True/False

- 1. (2 points) CPU times are generally much shorter than I/O times. (**T** / F)
- 2. (2 points) An `execl()` system call loads a binary file into memory and destroying the memory image of the program calling it (**T** / F)
- 3. (2 points) A system call is triggered by hardware (**T** / **F**)
- 4. (2 points) In Round-Robin scheduling, the time quantum of the first process is always smaller than the second process (**T** / **F**)
- 5. (2 points) In file systems, external fragmentation is one of the drawbacks in contiguous allocation approach (**T** / F)

Sample Questions

1. Describe three general methods used to pass parameters to the operating system during system calls.
2. Provide three reasons why a process may leave the Running state?
3. Explain the concept of a CPU–I/O burst cycle.
4. How many child processes does the following program create?

```
int main(void){
    pid_t pid1, pid2, pid3;

    pid1 = fork();
    pid2 = fork();
    pid3 = fork();
}
```

Answer:___7

5. Consider the following program. What is a possible output?

```
void main()
{
    pid_t pid;

    printf("Hello there\n");
    pid = fork();
    printf("What is up?\n");

    if (pid == 0)
    {
        printf("Nothing\n");
    }
    else
    {
        wait(NULL);
        printf("That is a relief\n");
    }
}
```

Answer:

Hello there
What is up?
What is up?
Nothing
That is a relief

7. Process control block (PCB) holds various information related to a process. Name any three of them.
8. Assuming the following table consists of a set of jobs to be processed on a single CPU. Assume that the processes are already in the ready queue and they arrived in the order p1, p2, p3, and p4

Job	Burst
p1	8 ms
p2	5 ms
p3	6 ms
p4	2 ms

- i. Compute the average waiting time assuming that the scheduling policy is First Come First Serve (FCFS).

Answer:

p1_wait = 0; p2_wait = 8; p3_wait = 8+5=13; p4_wait = 8+5+6=19

Avg_wait = (0 + 8 + 13 + 19) / 4 = 10ms

8. Why multi-level page tables are required?
9. Explain the sequence of events that happens when a page-fault occurs.
10. Assume a system has a TLB hit ratio of 90%. It requires 15 nanoseconds to access the TLB, and 85 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?

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