



Exam : Operating Systems 1 (OS 1)

Duration: 1h 30 - Documents: not allowed First Name :
Academic year : 2025 / 2026 Last Name :
Level : L2 Semester : 5 Group :
Date : 10/05/2026 (08 : 30 – 10 : 30) **Score : ··· / 20**

Exercise 1 : (Understanding Questions) (4.5 Points / 15 Minutes)

- Q1)** The text section of a process contains the program code; what are the other sections of the memory allocation for a process?
.....
- Q2)** What are the two components of a virtual address used in segmented virtual memory?
.....
- Q3)** Identify the following in one phrase or sentence (do more than just expand the acronym, though).
- a) PTE (Page Table Entry) :**
.....
- b) Working set :**
.....
.....
- c) Thrashing :**
.....
.....
- Q4)** Would increasing the number of frames always decrease the number of page faults for a particular reference string for FIFO? Why or why not?
.....
.....
- Q5)** The CPU scheduling can be preemptive and non-preemptive, what is the main difference between them?
.....
.....
.....
.....

Exercise 2 : (Logical Addresses & Physical Addresses) (3 Points / 15 Minutes)

Q1) In paging, given the logical address **0xAFF9** (in hexadecimal) with a page size of **256 bytes**, what is the page number and offset in decimal?

.....

.....

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.....

Consider the following segment table (in hexadecimal) :

Segment #	Limit	Base
0	0x1000	0x1400
1	0x0400	0x6300
2	0x0400	0x4300
3	0x1100	0x3200
4	0x1000	0x4700

Q2) What are the physical addresses (in decimal) for the following logical addresses (segment # and offset)?

a) < 1, 1 048 >

.....

.....

b) < 3, 1 048 >

.....

.....

Q3) What are the logical addresses (segment # and offset) for the following physical addresses (in decimal)?

a) 16 384

.....

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.....

.....

.....

b) 6 144

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Exercise 3 : (Unix Process Creation) (2.5 Points / 10 Minutes)

Consider the following section of the code and assume that all fork system calls are successful.

```
void main() {
    int j = 2;
    pid_t pid;
    while (j >= 1) {
        pid = fork();
        j=j-1;
        if (pid > 0) {
            printf("In parent %d. \n", j);
        }
        else {
            printf("In child %d. \n", j);
        }
    }
}
```

Q1) What value is returned if **fork** system call is not successful?

.....

Q2) Draw a process tree for the above program.

.....

Q3) What will be printed?

.....

Exercise 4 : (CPU Scheduling) (4.5 Points / 20 Minutes)

Consider a single-processor system and the four processes **A**, **B**, **C** and **D**, which perform computation and I/O with a disk according to the times given below.

Arrival Time	Process	1 st CPU	1 st I/O	2 nd CPU	2 nd I/O	3 rd CPU
0	A	2	3	2	3	2
2	B	4	1	4	-	-
3	C	2	1	2	-	-
6	D	1	1	1	1	1

The processes are available from the start, in this order : **A** then **B** then **C** then **D**. Give the execution charts for the following scheduling algorithms:

Exercise 5 : (Paging) (3 Points / 15 Minutes)

Consider a system using paging technology and having the following characteristics:

- A page table with **2^{16} entries**
- Each page table entry is coded on **16 bits**. An entry contains a frame number reference and a presence/absence bit.
- The offset is coded on **16 bits**
- A virtual address is indexed by **8 Byte**

Answer the following questions, always justifying your answer:

Q1) What is the size of a page?

.....
.....

Q2) How many frames does physical memory contain?

.....
.....
.....
.....
.....
.....

Q3) What is the size of physical memory?

.....
.....
.....

Q4) What is the size of virtual memory?

.....
.....
.....

Q5) What is the size of the address bus in bits for this system?

.....
.....
.....
.....

Exercise 6 : (Replacement Algorithms) (4.5 Points / 15 Minutes)

Consider the following page reference string: 2, 5, 7, 3, 1, 1, 2, 7, 0, 3, 6, 5, 4, 3, 7

Assuming demand paging with four frames, how many page faults would occur for the following replacement algorithms?

a) FIFO

FIFO															
Reference String	2	5	7	3	1	1	2	7	0	3	6	5	4	3	7
Frame 1															
Frame 2															
Frame 3															
Frame 4															
Page Fault															
Page Fault =															

b) LRU (Least Recently Used)

LRU															
Reference String	2	5	7	3	1	1	2	7	0	3	6	5	4	3	7
Frame 1															
Frame 2															
Frame 3															
Frame 4															
Page Fault															
Page Fault =															

c) Second-Chance

Second-Chance															
Reference String	2	5	7	3	1	1	2	7	0	3	6	5	4	3	7
Frame 1															
Frame 2															
Frame 3															
Frame 4															
Page Fault															
Page Fault =															

Good Luck
