2014/2015 SEMESTER ONE EXAMINATION

Diploma in Computer Engineering
Diploma in Electrical & Electronic Engineering
3rd Year Full-Time

ET0023 OPERATING SYSTEMS Time Allowed: 2 Hours

Instructions to Candidates:

1. The examination rules set out on the last page of the answer booklet are to be complied with.

2. This paper consists of **TWO** sections:

   Section A - 20 Multiple Choice Questions, 2 marks each.
   Section B - 6 Short Answer Questions, 10 marks each.

3. **ALL** questions are **COMPULSORY**.

4. All questions are to be answered in the answer booklet. Start each question on a new page for Section B.

5. This paper consists of 8 pages (inclusive this cover page).

SECTION A: MULTIPLE CHOICE QUESTIONS (2 marks each)

1. For each question, select ONE correct answer
2. Tick your answers in the box behind the front cover of the answer booklet.
3. No marks will be deducted for incorrect answers.

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1) Comparing the four computer systems below, which is the one that has been first used and deployed as earliest computer generation?

   a) Mainframe.
   b) Minicomputer.
   c) Microcomputer.
   d) Handphone.

2) When a computer process is running, the immediate operands and Temp storage locations for intermediate calculations by the CPU is found in the _____.

   a) general registers
   b) program counter
   c) stack pointer
   d) program status word

3) An Operating System provides five important functions as depicted in the Operating System pyramid diagram. The part of the operating system that manages the CPU is called the _____ function.

   a) Memory management
   b) File and Storage allocation
   c) Software program compilation
   d) Processes handling

4) Which one of the following components in the memory hierarchy usually has the largest storage space or capacity in a home computer?

   a) Registers
   b) Level 2 Cache
   c) ROM BIOS
   d) Main memory

5) All the information about each process is stored in an operating system structure called the _____

   a) Process memory.
   b) Process table.
   c) Process scheduler.
   d) Process link.

6) A process is calculating an mathematical equation, however, an unexpected over-flow error occurred. The process will be terminated with an exit status of

a) normal exit (voluntary).
b) error exit (voluntary).
c) fatal error (involuntary).
d) killed by another process (involuntary).

7) Which one of the following statements below is not true about a thread?

a) Threads are the entities scheduled for execution on the CPU.
b) One or more processes run inside a thread.
c) Threads are mini-versions of processes and are sometimes called lightweight processes.
d) Each thread will have its own private elements not shared by other threads.

8) Which one of the following technologies is used in solid-state-drive for data storage?

a) Magnetic storage
b) Optical memory
c) EEPROM
d) DDR RAM

9) The operating system has just loaded five processes, A, B, C, D and E. They have estimated running times of 6, 4, 3, 5 and 2 minutes. Their priorities are 3, 5, 2, 1, and 4, respectively, with 5 being the highest process priority.

If shortest-job-scheduling is used, what is the scheduling order of these processes?

a) A --> B --> C --> D --> E
b) E --> C --> B --> D --> A
c) B --> E --> A --> C --> D
d) D --> C --> A --> E --> B

10) Which one of the following application scenarios below **may not** be useful for running multiple threads?

a) We want to make the application more interactive and have better responsiveness.
b) We want to improve the performance of a server application by serving multiple requests at the same time.
c) We have an application that must run sequentially and cannot be parallelized due to certain constraints and dependencies.
d) We have an application that processes large amount of data.

11) Assume that a system has 4 GB of main memory divided into 2KB pages. How many pages will be required to access all the 4 GB main memory?

a) 1 M
b) 2 M
c) 4 M
d) 16 M

12) Which one of the following is **not** a necessary condition for causing a Deadlock?

a) Mutual exclusion
b) Hold and wait
c) Preemption
d) Circular wait

13) What is the latency time for a 7200 RPM hard disk drive?

a) 4.2 msec.
b) 6.0 msec.
c) 8.3 msec.
d) 10 msec.

14) The different properties of a file such as the owner of the file and the date/time of creation are called _____.

a) File operations
b) File naming
c) File structure
d) File attributes

15) Information about the starting and ending addresses of each partition is stored inside the _____.

a) Master boot record (MBR)
b) Partition table
c) Boot block
d) Super block

16) Linux uses _____ to keep track of which disk blocks go with which file.

a) File Allocation Table
b) Linked-list allocation
c) Linked-list allocation using a table in memory
d) I-nodes

17) Which one of the following file permissions would allow **read-write** access only to the owner and group members in a Linux file system?

a) 640
b) 660
c) 770
d) 777

18) In modern Linux systems, which file contains the users' encrypted login password?

a) /etc/shadow
b) /etc/passwd
c) /etc/host
d) /home/passwd

19) Which one of the following characters does the bash shell use for redirecting output?

a) +
b) -
c) >
d) .

20) In RHEL Linux systems, the user ID of root is _____.

a) 0
b) 1
c) 500
d) 1001

Section B: Short Answer Questions (60 Marks)

1. Answer all questions in this section in your answer booklet.
2. Start each question on a new page.
3. Each question carries 10 marks.

B1.

a) Briefly explain the role of an Operating System in a computer system. [2 marks]

b) Briefly explain the term Application Programming Interface as applied to an Operating System. Hence give an example how API helps in the development of software. [4 marks]

c) As depicted in the Operating Systems pyramid diagram, providing user interface is one of the Operating System functions. Briefly name and explain any two of the other OS functions. [4 marks]

B2.

a) Briefly explain the relation of thread and process and how thread is created.[2 marks]

b) Name two shared and two non-shared elements in threads from a process control block. [4 marks]

c) State two advantages of using multiple threads in parallel in a process. [4 marks]

B3.

a) Briefly explain (i) batch processing and (ii) time Slice operations in a computer system. [4 marks]

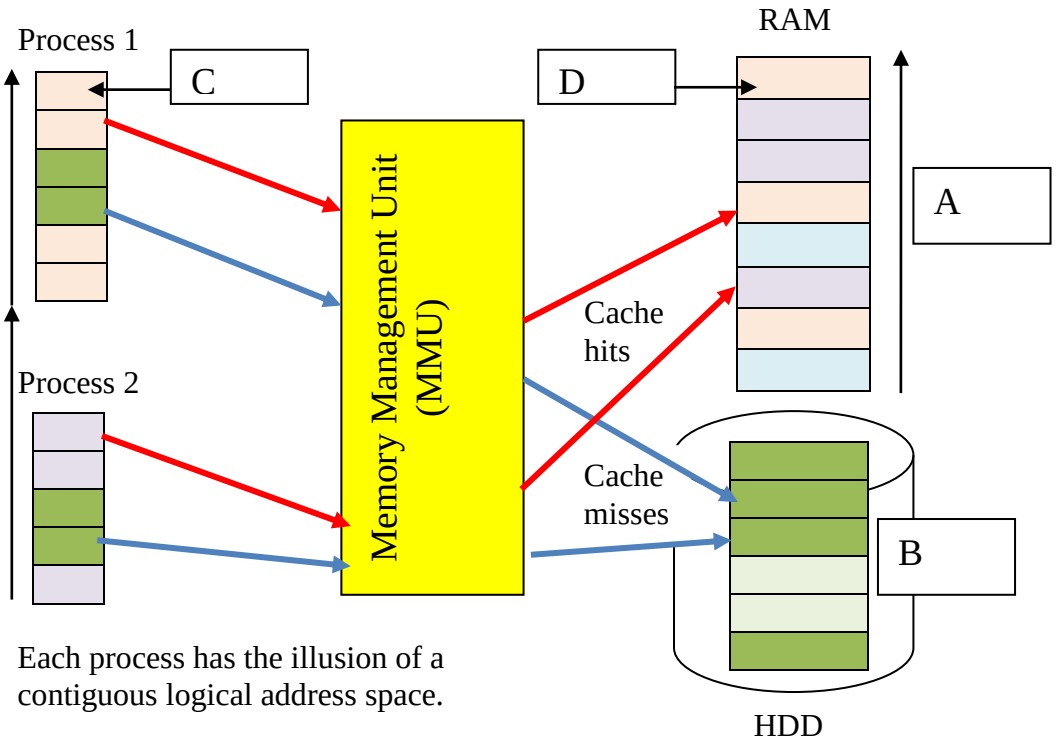
b) Assuming the processes P1, P2, P3 and P4 arrive at different time. The order of the jobs, burst time and arrival time are given in the table:

Order	Process	Burst time (min)	Arrival time (min)
1	P1	5	0
2	P2	8	2
3	P3	10	3
4	P4	6	4

Assuming that the first process start immediately at t=0, calculate the average turnaround time and average waiting time for the processes using the non-preemptive Shortest-Job-First (SJF) scheduling. Show your workings for processes in SJF order. [6 marks]

B4.

a) The following diagram shows how Virtual memory works. Fill in the blanks which correspond to the four boxes in the diagram with the terms: logical address space, physical address space, one page, one frame, virtual memory. [4 marks]



Each process has the illusion of a contiguous logical address space.

A: _____; B: _____;

C: _____; D: _____;

b) We have a paging system with 4 frames and 13 pages. The number of frames denotes the number of pages that can be held in RAM at any given time. The pages are accessed by some process in the order shown below. The process has just started and the frames are initially empty.

Order in which pages are accessed: from left to right

1, 3, 2, 5, 3, 4, 6, 2, 5, 3, 2, 5, 4

If the LRU (Least Recently Used) algorithm is used, how many page faults will be generated? Show your working. [6 marks]

B5.

a) Name two benefits of Virtual Memory in modern Operating Systems. [4 marks]

b) Using a schematic diagram to show the construction of a **RAID 5** system using 6 hard disk drives. [4 marks]

c) Using even parity, what is the above RAID 5 storage data pattern for a user data pattern of **10110**. [2 marks]

B6.

a) The following is the output of an **ls** shell command on directory **/common.** You may assume that directory **/common** is **read-write-execute**-able by all users.

```
[student@stationX ~ ] $ ls -l /common
    total 4
drwxrwxr-x   1   student  test   4096   Sep 30   21:09   projects
-rw-rw-r--   1   student  john   512    Sep 30   21:08   report
lrw-rw-r--   1   student  test   6      Sep 30   22:09   etcptr -> /etc/
```

i) What is the size of the file **projects** in bytes?
ii) What information will be displayed when listing the file etcptr (i.e. **ls etcptr**)?
iii) Which users (other than root) can write into the file **report**?
[6 marks]

b) The student user requires the above **report** file to be **read-write-execute-**able by user **student** and members of the **test** group. Also all other users can only read the file. How do you prepare the **report** file using command line interactive **commands** for this purpose? [4 marks]

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