<u>2017/2018 SEMESTER ONE EXAMINATION</u>

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

OPERATING SYSTEMS   <u>Time Allowed</u>: 2 Hours

<u>Instructions to Candidates</u>:

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. Fill in the Question Numbers in the order that it was answered, in the box found on the front cover of the answer booklet, under the column "Question Answered".

6. This paper consists of 9 pages (inclusive cover page).

SECTION A: MULTIPLE CHOICE QUESTIONS (2 marks each)

1. For each question, select <u>ONE</u> 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.

A1) Which one of the following components is not found inside the CPU IC chip?

   a) General Registers
   b) Program Counter
   c) L3 Cache
   d) Program Status Word

A2) The CPU contains _____ to hold key variables and temporary results.

   a) General Registers
   b) Program Counters
   c) Arithmetic and Logic Units (ALU)
   d) Program Status Words

A3) All the information about each process is stored in an operating system structure called the _____.

   a) Process Memory
   b) Process ID
   c) Process Scheduler
   d) Process Control Block

A4) Which one of the following terms is **NOT** related to high speed memory devices?

   a) Cache
   b) Stack
   c) Cluster
   d) Buffer

A5) Which one of the following components is **NOT** shared among threads within a process?

   a) Address space
   b) Registers
   c) Global variables
   d) Open files

A6)   Arrange the following memory components in descending access time (from fastest to the slowest) in the memory hierarchy.
   a)   Main Memory – Register – Solid State Drive – Hard Disk Drive
   b)   Register – Main Memory – Solid State Drive – Cache
   c)   Main Memory – Solid State Drive – Hard Disk Drive – CDROM
   d)   Main Memory – CDROM – Hard Disk Drive – Solid State Drive

A7)   Which one of the following state transitions is not allowed for a process?

   a)   Waiting → Ready
   b)   Running → Ready
   c)   Waiting → Running
   d)   Running → Waiting

A8)   A process is calculating a mathematical equation; however, an unexpected over-flow error has 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)

A9)   Which one of the following scenarios is **NOT** suitable to utilize the benefits of running multiple threads?

   a)   We want to make an application 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 a standalone single-tasking process that cannot be interrupted.
   d)   We have an application that processes large amount of data.

A10) An 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 Priority-Scheduling algorithm 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

A11) A computer system has 4 GB of main memory divided into equal pages of 4 KB. 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

A12) What is the average latency time for a 7200 RPM hard disk drive?

    a)   4.2 msec
    b)   6.0 msec
    c)   8.3 msec
    d)   10.0 msec

A13) The _____ is stored in the sector 0 of secondary memory. It is used to boot the computer.

    a)   Partition Table
    b)   Boot Block
    c)   Super Block
    d)   Master Boot Record (MBR)

A14) Which one of the following approaches is used to prevent the **"Hold and Wait"** deadlock condition?

    a)   Spool everything.
    b)   Request all resources initially.
    c)   Take resources away.
    d)   Order resources numerically.

A15) Which one of the following statements is **NOT** a goal of Process Scheduler in operating systems?

    a)   Minimize Latency
    b)   Maximize Throughput
    c)   Maximize Utilization
    d)   Maximize Switching

A16) USB thumb drives generally use _____ file system to share files between Linux and Windows operating systems.

    a)   xfs
    b)   NTFS
    c)   ext4
    d)   FAT

A17) What is Root ID in Red Hat Linux?

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

A18) Which one of the following file permissions would allow read-write-execute access to the file owner, read-write access to the file group members, and read access to other users in a Linux file system?

  a) 764
  b) 664
  c) 760
  d) 765

A19) In a Linux operating system, the daemon that handles execution of commands/scripts automatically at a specific date and time is _____.

  a) syslog
  b) vsftpd
  c) crond
  d) httpd

A20) Which one of the following items is more common between Android OS and iOS?
  a) The User Interface
  b) The OS Kernel
  c) The Memory Management
  d) The File System

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 differences between a real resource and a virtual resource in a computer system.

[2 marks]

c)   List four functions of an Operating System.

[2 marks]

d)   Briefly explain the term **Application Programming Interface**.

[2 marks]

e)   Briefly explain the **Cooperative Multi-tasking**.

[2 marks]

B2.
a)   Briefly explain the relationship of Program, Process, and Thread.

[2 marks]

b)   Briefly explain the difference between **CPU-bound** and **I/O-bound** processes.

[2 marks]

c)   See the empty Process States diagram in Figure B2:
        i.   Specify the states for each of the five state blocks.
        ii.   Draw arrows between each state block to show the direction of transition between states. Specify the transition state for each arrow.
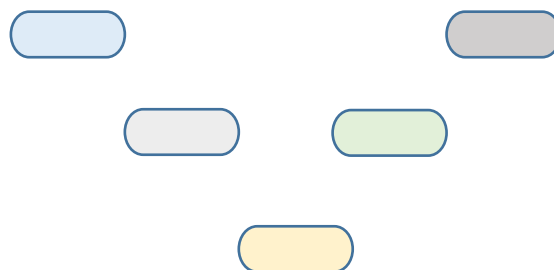
Figure B2

[6 marks]

B3.

a)   Briefly explain one advantage and one disadvantage in using First-Come-First-Serve (FCFS) process scheduling policy.

[2 marks]

b)   Starvation is a common problem in priority process scheduling. Describe a situation where starvation occurs and suggest one solution to reduce the problem.

[2 marks]

c)   There are four processes P1, P2, P3, and P4 in waiting queue. The burst time of the jobs and arrival times are given in Table B3.

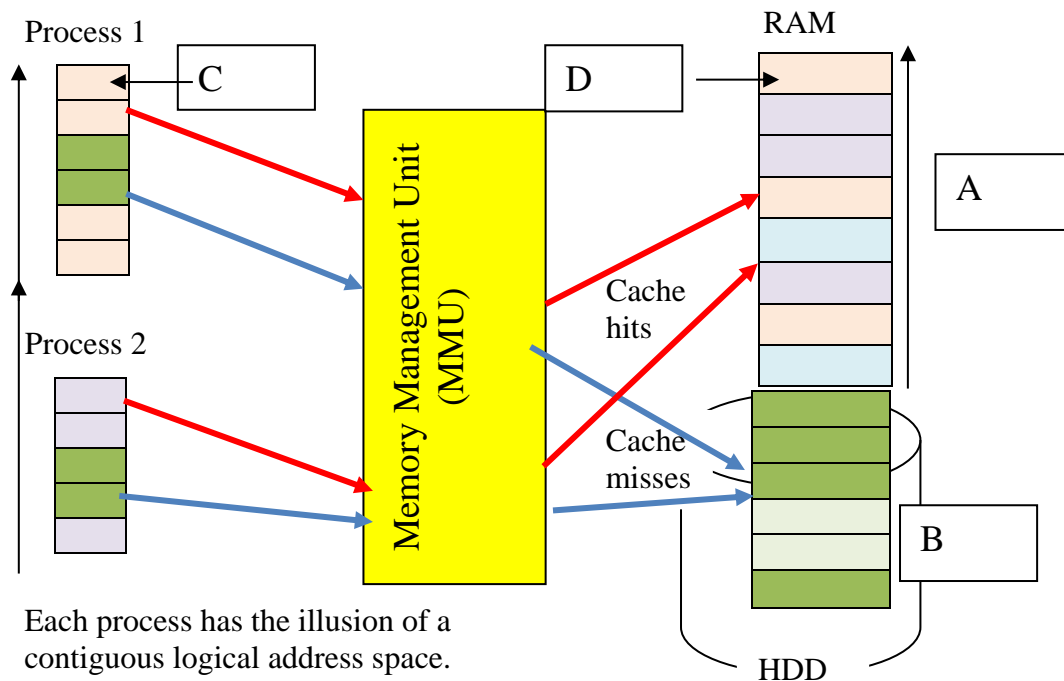| Process	Burst time (min)	Arrival time (min)
P1	2	0
P2	4	4
P3	8	3
P4	6	2

Table B3

Calculate the average turnaround time and average waiting time for the four processes above using the First-Come-First-Serve (FCFS) process scheduling. Show your workings.

[6 marks]

B4.

a) Figure B4 shows how Virtual memory works. Match the four boxes (A to D) in the diagram with the following terms: Swap space; logical address space; physical address space; one page; one frame. Not all terms are used. Write your answer in the answer booklet.

[4 marks]

Process 1

C

D

RAM

A

Memory Management Unit (MMU)

Process 2

Cache hits

Cache misses

B

HDD

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

Figure B4

b) Briefly explain two differences of **Swapping** and **Paging**.

[2 marks]

c) 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 processes in the order shown below. The paging system has just started and the frames are initially empty.

Order in which pages are accessed: from left to right

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

If the FIFO (First-In-First-Out) algorithm is used, how many page faults will be generated? Show your working.

[4 marks]

B5.

a)   Name two comparative advantages of Cloud Storage vs Direct Attached Storage (DAS).

[2 marks]

b)   A 7200 rpm disk drive has an average 600 sectors per track. Each sector stores 512 bytes of user data. What is the internal transfer rate (in Mbytes per second) of this disk drive?

[2 marks]

c)   Using a schematic diagram, show the construction of a RAID-5 system using **four** hard disk drives.

[2 marks]

d)   What is the efficiency (in %) of a RAID-5 system using **four** hard disk drives?

[2 marks]

e)   State two advantages of Hardware RAID.

[2 marks]

B6.

a)   Figure B6 shows the output of shell command **ls** on directory **/home/common.** You may assume that directory **/home/common** is **read-write-execute**-able by all users.

```
[student@stationX ~ ] $ ls  -l  /home/common
total   1
-rwxrwxr-x     1     student  student  2048     Sep 30      20:16     projects
-rw-r--r--     1     student  john     512      Sep 30      21:08     report
-rw-rw-r--     1     student  test     6        Sep 30      22:09     code
```

Figure B6

        i)   What is the size of the file **report** in bytes?
        ii)   Which users (other than root) can write into the file **report**?
        iii)   What is the shell command for deleting the directory **common** (including all its files and sub-directories) by user **student**?

[4 marks]

b)   The user **student** requires the above **code** file to be **read-write-execute-**able by user **student** and members of the group **john** only, while all other users can neither read nor write into the **code** file.
        How do you prepare the **code** file using CLI **commands** for this purpose?

[4 marks]

c)   The user **student** wishes to mount a partition recognized as **/dev/sdb1** to the filesystem. How do you mount this partition to **/home/common** using CLI commands?

[2 marks]

– End of Paper –