2014/2015 SEMESTER TWO EXAMINATION

Diploma in Computer 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 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) The CPU contains some _____ inside to hold key variables and temporary results.

a) general registers
b) program counters
c) Arithmetic and Logic Units (ALU)
d) program status words

2) Microsoft recommends having at least _____ GB of physical memory for 64-bit Windows 8.1 Operating System.

a) 0.5
b) 2
c) 4
d) 8

3) The main memory of a computer is divided into 4-KB pages (1KB is 1024 bytes). Assuming that the virtual page number starts at 0, the virtual page number for decimal virtual address 20000 is _____.

a) 1
b) 4
c) 6
d) 10

4) _____ allow user programs to access the I/O resources through the operating system.

a) User interfaces
b) Utility programs
c) User program codes
d) Application Program Interfaces (APIs)

5) Which one of the following statements is **not** true about a process?

a) A process is created by software programmers.
b) A process is basically a program in execution - it is a running program.
c) Processes use up main memory and CPU time.
d) All the information about each process is stored in the process control block.

6) Which one of the statements below is **not** a characteristic of **pre-emptive multi-tasking**?

a) If a job requires more time to complete, it can request for more time slices to complete the job.
b) When the time slice of a job is up, the scheduler will remove the job and replace it with another job.
c) The time-slice of each job is managed by the Job Scheduler.
d) Multiple jobs are run on a single processor one at a time.

7) Which one of the following terms below is **not** related to the low level formatting of hard disk drive?

a) Sectors
b) Tracks
c) Clusters
d) Cylinders

8) Which one of the following is a shared component among threads within a process?

a) Address space
b) Registers
c) Program Counter
d) Stack

9) Which one of the following statements most accurately describes a process that is currently in the running state?

a) The process is currently using the CPU at that instant.
b) The process is runnable, but is waiting in a queue.
c) The process is unable to run until some external event happens.
d) The process no longer has an entry in the process table.

10) 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

11) Which one of the following methods is **not** a method of recovery from a Deadlock?

a) Recovery through preemption
b) Recovery through rollback
c) Recovery through killing processes
d) Recovery through unsafe states

12) Race Condition is hard to detect in multiple threads from a single process because

a) it requires a powerful CPU for complex computation.
b) Race Condition is intermittent and timing dependent.
c) OS needs to allocate large amount of resources to detect Race Condition.
d) Race Condition is OS and resources dependent.

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

a) Magnetic storage
b) Optical memory
c) Flash memory
d) DRAM

14) The efficiency of a RAID-1+0 system constructed with **four** 1 TB hard disk drives is _____.

a) 25 %
b) 50 %
c) 75 %
d) 100 %

15) Sector 0 of a hard disk is also called the _____.

a) Master Boot Record (MBR)
b) Boot block
c) Partition table
d) Root directory

16) Which one of the following is **not** an advantage in using modern Linux operating systems over other proprietary OSs (e.g. Windows OS)?

a) Low cost – Most Linux OSs are freely downloadable.
b) Good community support.
c) Ease of use and trouble-free installation.
d) Bug fix is fast and frequent, you can even do it yourself.

17) Modern Linux systems use _____ to keep track of file attributes and disk block addresses of files.

a) Contiguous Allocation
b) Linked-list Allocation
c) File Allocation Table (FAT)
d) I-nodes

18) Which one of the following file permissions would only allow read-write access to the file owner and no access to group members or other users in a Linux file system?

a) 640
b) 600
c) 770
d) 777

19) In a Linux Apache server system, the daemon that listens for web service requests is _____.

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

20) The bash shell command to create an empty text file **file1** is _____.

a) cat file1
b) mkfile file1
c) mkdir file1
d) touch file1

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 define what an Operating System is. [2 marks]

b) Briefly explain the operation of the two distinct modes, kernel and user mode, in a process managed by the Operating System. [2 marks]

c) Using a simple diagram with 3 processes, briefly explain how **Time Slice operation** technique allows an operating system to manage **multi-tasking** in a computer system. [2 marks]

d) A modern computer memory system consists of many different types of memory devices. Use the table below to show a typical memory hierarchy with 4 different types of memory devices. Arrange the memory devices in descending access time.

Typical access time	Memory Device	Typical memory capacity

[4 marks]

B2.

a) Briefly explain why process switching in pre-emptive multitasking environment is considered expensive compared to threads switching. [2 marks]

b) State one advantage of using multi-threads over single-thread in a HTTP web server. [2 marks]

c) In a server, it takes 20 msec to get a request to work, dispatch and do the rest of the necessary processing, when the data needed are in the block cache. On average, every three block cache accesses is followed by one hard disk access when the data required is not in the block cache. During hard disk access operation, an additional 80 msec is required and the thread sleeps.

(i) How many requests per second can the above server handle if it is a single-threaded process? [4 marks]

(ii) How many requests per second can the above server handle if it is a multi-threaded process? [2 marks]

B3.

a) Briefly state one advantage and one disadvantage for each of the two following scheduling schemes:
(i) First-Come-First-Serve (FCFS) (ii) Shortest-Job-First (SJF) [4 marks]

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

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

Calculate the average turnaround time and average waiting time for the 4 processes using the First-Come-First-Serve (FCFS) scheduling. Show your workings. [6 marks]

B4.

a) Give two benefits of using virtual memory in memory management. [2 marks]

b) Using a diagram, explain how Virtual Memory works. Your diagram should clearly label and show the use of: [4 marks]

(i) pages and frames
(ii) physical memory and virtual memory
(iii) Memory Management Unit
(iv) cache hits and cache misses

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 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, 4, 5, 2, 4, 7, 5, 4, 6, 2, 5

If the FIFO (Frist-In-First-Out) algorithm is used, how many page faults will be generated? Show your working. [4 marks]

B5.

a) Using the even parity scheme, fill in the parity bit for the following two bit patterns:

i) **0101_** ii) **1011_** [2 marks]

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

c) Using the result in a) above, store the bit patterns (including the even-parity bit) on the RAID-5 system. Show the two bit-patterns clearly on your RAID-5 system.

Note: You may store one bit on one HDD for each of the bit patterns. [4 marks]

B6.

a) The following is the output of an **ls** shell command on student home directory**.** The user student has edited a bash file **report.sh** for execution.

```
[student@stationX ~ ] $ ls -l
    total 1
-rw-rw-r--    1    student  student  204    Jan 30    21:08    report.sh
```

i) What is the file size of **report.sh** in bytes?
ii) What is the bash shell command for creating a sub-directory **Prog** in student's home directory?
iii) What is the bash shell command for moving the file **report.sh** from the home directory into the sub-directory **Prog**? [6 marks]

b) The user **student** requires the above **report.sh** bash file to be read-write-executable by user **student** and members of the **test** group. All other users can only read the file.

How do you prepare the **report.sh** bash file using interactive bash shell commands for this purpose? [4 marks]

– End of Paper –