

**2016/2017 SEMESTER ONE EXAMINATION**

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

**ET0023 OPERATING SYSTEMS**

Time Allowed: 2 Hours

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**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) Which one of the following components is not found inside the CPU IC chip?
  - a) General registers
  - b) Program counters
  - c) L3-cache
  - d) Program status words
  
- 2) Which one of the following statements below is 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) Each job is managed using first-come-first-serve scheduler till job completion.
  - d) Multiple jobs are run on a single processor in parallel at the same time.
  
- 3) Which one of the terms listed below is **not** related to high speed memory devices used for speeding up computer operations?
  - a) Caches
  - b) Stacks
  - c) Clusters
  - d) Buffers
  
- 4) Which one of the following components is **not** shared among threads within a process?
  - a) Memory space
  - b) Registers
  - c) Process ID
  - d) Files
  
- 5) Which one of the following statements is **not** allowed in Unix process hierarchies?
  - a) A Unix process can have only one parent.
  - b) All the processes in a Unix system belong to a single tree.
  - c) Processes in Unix system can disinherit their children processes.
  - d) Process can interact with other processes through inter-process-signals.

- 6) Which one of the following technologies is used in hard disk drive for data storage?
- a) Magnetic storage
  - b) Optical memory
  - c) EEPROM
  - d) DRAM
- 7) The Master Boot Record (MBR) of an operating system is stored in the \_\_\_\_\_ of a hard disk drive.
- a) sector 0
  - b) middle cylinder
  - c) end cylinder
  - d) external memory buffer
- 8) Which one of the following statements is a reason for using an open-source operating system (such as Linux OS) over a proprietary OS (such as Windows OS)?
- a) Low cost – Most open-source OSs are freely downloadable.
  - b) Good technical support from vendors.
  - c) Ease of use and trouble-free installation.
  - d) Open-source operating systems are generally bug-free.
- 9) 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
- 10) Which one of the following is a likely cause of stack overflow in process execution?
- a) The cpu is running a large number of processes.
  - b) The cpu is running a process that required a lot of RAM memory for its code.
  - c) The cpu is running an iterative process with a large number of recursive calls.
  - d) The cpu is busily swapping virtual memory into its RAM space.
- 11) Arrange the following memory components in decending access time (from fastest to the slowest) in the memory hierarchy.
- a) Main Memory – Registers – Solid State Drive – Cache
  - b) Register– Main Memory – Cache – Solid State Drive
  - c) Main Memory – Hard Disk Drive –Solid State Drive – CDROM
  - d) Cache – Main memory – Solid State Drive – Hard Disk Drive

- 12) 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 priorities-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
- 13) An Operating System provides five important functions as depicted in the Operating System pyramid diagram. The part of the operating system that manages the virtual-memory is the \_\_\_\_\_.
- a) memory management
  - b) file and storage management
  - c) software program compilation
  - d) processes and scheduling management
- 14) Assume that a system has 4 GB of main memory divided into 1KB 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
- 15) What is the likely access time for a 10000 RPM hard disk drive?
- a) 10 second
  - b) 10 millisecond
  - c) 10 microsecond
  - d) 10 nanosecond
- 16) What is the efficiency (in %) of a RAID-5 system constructed with **four** 1- TB hard disk drives?
- a) 10
  - b) 75
  - c) 50
  - d) 100

- 17) The file system technique for keeping track of file integrity during writing of files is
- a) journaling
  - b) indexing
  - c) link-list
  - d) FAT
- 18) Which one of the following file permissions would only allow read-write-execute access to the file owner and group members while granting no access to any 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 request is \_\_\_\_\_.
- a) syslog
  - b) vsftpd
  - c) crond
  - d) httpd
- 20) The Android, Fedora and Ubuntu OS are considered as Linux distributions because they share a similar
- a) user interface.
  - b) Linux kernel.
  - c) built number.
  - d) vendor.

**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.
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B1.

- a) Briefly explain the role of an Operating System in a computer system. [2 marks]
- b) Briefly explain why a RISC-based computer design reduces heat generation compared to a CISC-based computer design. [2 marks]
- c) Briefly define **batch processing** and explain how **spooling** technique of an operating system improves **batch processing** in a computer system. [2 marks]
- d) Briefly explain how **instruction pipeline** technique of an operating system improves **linear processing** in a computer system. [2 marks]
- e) Briefly describe the difference between cloud computing and traditional desktop computing. [2 marks]

B2.

- a) In normal situation, a computer process completes its task and exits gracefully from the system. However there are situations where the processor may be forced (involuntary) to terminate the process before its assigned task is completed.  
  
Give one situation where a computer process will exit involuntarily. [2 marks]
- b) Briefly explain why multiple threads are useful in a web server process. [2 marks]
- c) In a web server, it takes 10 msec to get a request to work, dispatch and do the rest of the necessary processing, when the data needed are in the memory cache. On average, every three memory cache accesses is followed by one hard disk access when the data required is not in the memory cache. During hard disk access operation, an additional 40 msec is required and the thread sleeps.  
  
How many requests per second can the above web server handle if it is a single-threaded process? [4 marks]  
  
How many requests per second can the above web server handle if it is a multi-threaded process? [2 marks]

B3.

- a) Briefly explain why the Ostrich solution is used in handling deadlock in multi-threaded environment of a desktop computer.  
[2 marks]
- b) Briefly state one advantage and one disadvantage for First-Come-First-Serve (FCFS) scheduling scheme.  
[2 marks]
- c) Assuming that four processes P1, P2, P3 and P4 arrive at different time. The burst time of the jobs and arrival time are given in Table B3.

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

Table B3

Calculate the average turnaround time and average waiting time for the 4 processes above using the First-Come-First-Serve (FCFS) process scheduling. Show your workings.

[6 marks]

B4.

- a) Using a diagram, briefly explain how Virtual Memory works. Your diagram should clearly label and show the use of:  
(i) pages and frames  
(ii) physical memory and virtual memory  
(iii) Memory Management Unit  
(iv) cache hits and cache misses  
[4 marks]
- b) Briefly explain two benefits of using virtual memory allocation scheme in a multi-processing environment.  
[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 compared to a direct attached storage (DAS). [2 marks]
- b) A 10000 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 (HDD). [2 marks]
- d) How would you store the two user data patterns of **101** and **010** (one bit on each drive and underline the even parity bits) in the above RAID-5 storage system? [2 marks]
- e) Name two advantages of using solid state drive (SSD) to replace HDD in mass storage system. [2 marks]

B6.

- a) Figure B6 shows the output of an **ls** shell command on directory **/common**. You may assume that directory **/common** is **read-write-execute**-able by all users and user john is not a member of test group.

```
[student@stationX ~] $ ls -li /common
total 1
22316 -rw-r--r-- 1 student john 512 Sep 30 21:08 report
12543 -rw-rw-r-- 1 student test 86 Sep 30 22:09 etcptr
```

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 i-node number of the file **report**?
- iv) What is the bash shell command for deleting directory **/common** (including all its files) by user student? [6 marks]
- b) The user student requires the above **report** file to be **read-write**-able by user **student** and members of the **test** group only, while all other users can neither read nor write into the **report** file.  
How do you prepare the **report** file using CLI **commands** for this purpose? [4 marks]

- End of Paper -