

2015/2016 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) Which one of the following computer systems below is generally classified as the 3rd generation computer?
 - a) Mainframe
 - b) Minicomputer
 - c) Microcomputer
 - d) Handphone

- 2) The fast memory in the CPU that is used to temporarily store processor register data and other variables during a function call is the _____.
 - a) general register
 - b) program counter
 - c) stack
 - d) program status word

- 3) An Operating System provides five important functions as depicted in the Operating System pyramid diagram. Which one of the following functions is **NOT** part of the operating system 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 stores the immediate binary code and data for running process in a CPU?
 - a) Registers
 - b) Level 2 cache memory
 - 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 id
 - c) Process scheduler
 - d) Process control block

- 6) The most important process scheduling goal in a real-time system is _____.
- a) meeting deadline and avoid losing data
 - b) fast process execution to maximize throughput
 - c) every process should make progress with no job starvation
 - d) minimize turnaround time between submission and termination of processes
- 7) Threads are mini-versions of a process and are sometimes called lightweight processes because _____.
- a) threads are short cut to the process scheduled for execution on the CPU
 - b) one process can spin off many threads in the CPU
 - c) each thread requires few resources and minimum overhead is required for switching between threads
 - d) each thread has its full process table entry and are not shared with other threads
- 8) Which one of the following technologies is used in hard disk 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 and their priorities are 3, 5, 2, 1, and 4, respectively, with 5 being the highest process priority.
- If priority-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 applications below may **NOT** enjoy 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.

- 11) Assume that a computer system has 4 GB of main memory divided into 4KB 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 a necessary condition for causing a Deadlock?
- a) A linear wait
 - b) Holding requests can be dropped
 - c) Pre-emption capable resources
 - d) Mutual exclusion
- 13) Which one of the following file allocation method is implemented in the MS-DOS FAT-32 file system?
- a) Files are linked-lists of disk blocks where the first word of each block is used as a pointer to the next block.
 - b) Files are linked-lists of disk blocks where the block pointers are stored in memory as a table.
 - c) Each file is associated with a data structure called an i-node.
 - d) Files are stored as a contiguous run of disk blocks.
- 14) The _____ is stored in the sector 0 of hard disk drive. It is used to boot the computer.
- a) Master boot record (MBR)
 - b) Partition table
 - c) Boot block
 - d) Super block
- 15) 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
- 16) Which one of the following file permissions would allow **read-write-execute** access only to the owner and the group members in a Linux file system?
- a) 640
 - b) 660
 - c) 770
 - d) 777

- 17) In RHEL Linux systems, the user ID of root is _____.
- a) 0
 - b) 1
 - c) 500
 - d) 1001
- 18) What is the even parity bit for the bit pattern 1010?
- a) 1
 - b) 0
 - c) 10
 - d) x (don't care)
- 19) What is the benefit of a RISC-based CPU computer design approach?
- a) It requires significantly fewer transistors to reduce costs, heat and power use.
 - b) Program instructions are more compact and easy to program.
 - c) It increases instruction throughput by performing multiple operations in parallel.
 - d) Multiple execution core units are present for faster CPU operations.
- 20) Which one of the following items is likely common in iPhones and Android phones?
- a) The user interface
 - b) The kernel of the OSes
 - c) The feel and look of the devices
 - d) The price of the devices

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) What is the role of an Operating System in a computer system? State any two of the OS functions. [3 marks]
- b) Briefly explain how multi-tasking is achieved in a single core CPU computer system. [2 marks]
- c) Briefly explain the functions of the following components in the CPU:
(i) General registers (ii) PSW (iii) Stacks [3 marks]
- d) Give one advantage for using a compiler to create and run programs on a computer. [2 marks]

B2.

- a) Briefly explain the relationship of program, process and thread. [3 marks]
- b) Briefly explain how multiple threads can be used to improve user response and performance of a text editor. [3 marks]
- c) State the four essential conditions for the occurrence of deadlock in a multi-tasking environment. For each condition, also state a possible solution to resolve deadlock. [4 marks]

B3.

- a) Briefly explain one advantage and one disadvantage in using First-Come-First-Serve (FCFS) process scheduling policy. [4 marks]
- b) Assume that the processes P1, P2, P3 and P4 arrive at different times. The order of the jobs, burst times and arrival times are given in the table as shown below:

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

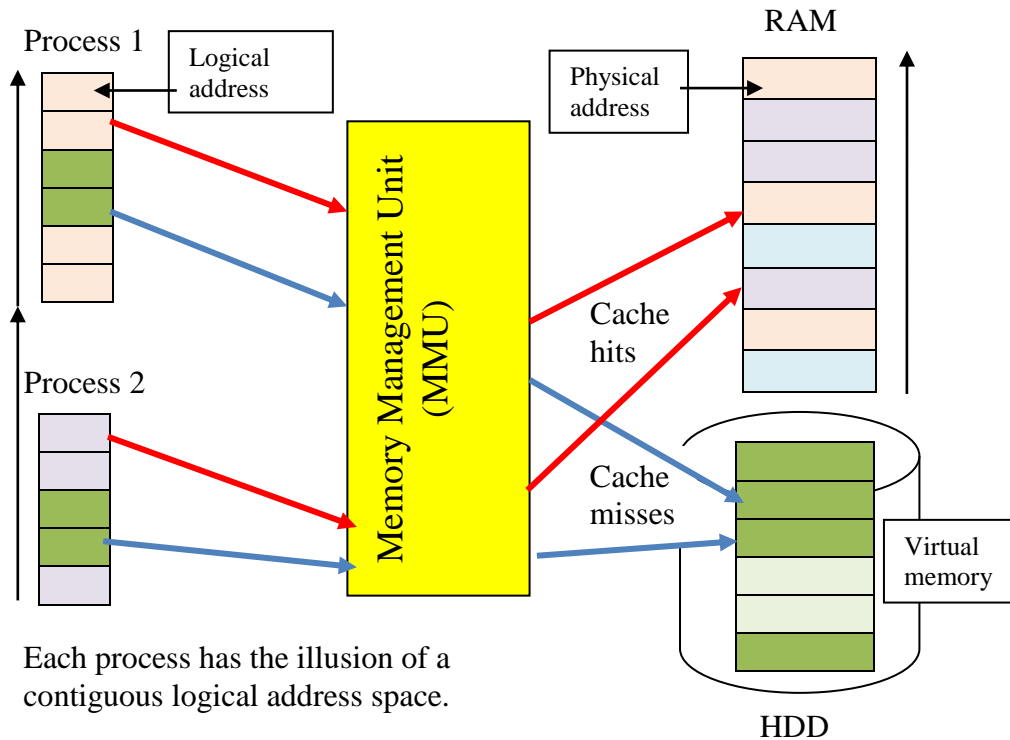
Assuming that the first process start immediately at $t=0$, calculate the average turnaround time and average waiting time for the processes using the non-preemptive First-Come-First-Serve (FCFS) scheduling. Show your workings for processes in FCFS order. [6 marks]

B4.

a)

- (i) Briefly define virtual memory and state two benefits of using virtual memory in memory management.
- (ii) Using the simple diagram below, briefly explain how virtual memory handles cache hits and cache misses.

[6 marks]



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

[4 marks]

B5.

- a) Name two benefits of using RAID systems in modern computer systems. [2 marks]
- b) Using a schematic diagram, show the construction of a RAID 5 system using 5 hard disk drives. [4 marks]
- c) Using even parity, what is the above RAID 5 storage data pattern for a user data patterns of 1010 and 0100. [2 marks]
- d) What is the efficiency of the above RAID 5 system using 5 hard disk drives? [2 marks]

B6.

- a) The following is the output of **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
```

```
-rwxrwxr-x    1  student  student  2048  Sep 30   21:09  projects
-rw-rw-r--    1  student  student   512  Sep 30   21:08  report
-rw-r--r--    1  student  test      6     Sep 30   22:09  osfile
```

- i) What is the size of the file **projects** in bytes?
 - ii) John is a member of the **test** group. Which file(s) above can John write to?
 - iii) Which users (other than **root**) can write into the file **report**?

[4 marks]
- b) The student user requires the above **report** file to be read-write-able by user **student** and members of the **test** group. Also all other users have no read-write permission on the file.
 - i) How do you prepare the **report** file using command line interactive commands for this purpose?
 - ii) User John wants to use the bash command **echo** to send the word "Greeting" into the file **report** without using a text editor. What is the full bash command **echo** for this purpose?

[6 marks]

----- End Of Paper -----