
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2015/2016 Academic Session

December 2015/January 2016

CST232 – Operating Systems
[Sistem Pengendalian]

Duration : 2 hours
[Masa : 2 jam]

INSTRUCTIONS TO CANDIDATE:

[ARAHAN KEPADA CALON:]

- Please ensure that this examination paper contains **FOUR** questions in **NINE** printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** soalan di dalam **SEMBILAN** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

- Answer **ALL** questions.

*[Jawab **SEMUA** soalan.]*

- You may answer the questions either in English or in Bahasa Malaysia.

[Anda dibenarkan menjawab soalan sama ada dalam bahasa Inggeris atau bahasa Malaysia.]

- In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi bahasa Inggeris hendaklah diguna pakai.]

1. (a) Given that main memory is composed of three page frames for public use and that a program requests pages in the following order:

a, d, b, a, f, b, e, c, g, f, b, g, c, f, b, d

- (i) Using the First-In First-Out (FIFO) page removal algorithm, perform a page trace analysis indicating page faults with asterisks (*). Then compute the failure and success ratios.
- (ii) Using the Least Recently Used (LRU) page removal algorithm, perform a page trace analysis and compute the failure and success ratios.
- (iii) Which page removal algorithm is better? Why do you think it is better?

(17/100)

- (b) Explain the fundamental differences between internal fragmentation and external fragmentation. Which type of fragmentation can be reduced by compaction? Explain your answer.

(8/100)

2. (a) Explain how you would design and implement a mechanism to allow the operating system to detect which, if any, processes are starving.

(5/100)

- (b) Given the following information:

Job	Arrival Time	CPU Cycle
A	0	10
B	2	12
C	3	3
D	6	1
E	9	15
F	11	9

Draw a timeline for each of the following scheduling algorithms.

- (i) First Come First Served (FCFS).
- (ii) Shortest Job Next (SJN).
- (iii) Shortest Remaining Time (SRT).
- (iv) Round robin (using a time quantum of 5, ignore context switching and natural wait).

(20/100)

3. (a) Computers have evolved from single processor architectures to multiprocessor architectures.

- (i) State **three (3)** different types of multiprocessing configurations that have been developed, as well as **one (1)** advantage and **one (1)** disadvantage for each configuration:

Configuration	Advantage	Disadvantage
I.		
II.		
III.		

- (ii) The current trend is for multicore processors to replace identical multiprocessors in computer systems. Briefly explain **one (1)** major issue faced by multicore processor systems compared with multiprocessor systems, and what approaches have been used to overcome the issue.

(13/100)

- (b) Critical regions need to be protected in a system running multiple parallel processes. Semaphores represent one way in which access to critical regions are protected.

A semaphore A used to access a given critical region, three processes P1, P2, and P3, and the following sequence of Semaphore operations Test(A) and Increment(A).

Determine which process is running in the critical region, which process(es) are blocked, and the value of A, for each step in the sequence of operations by filling in the table below.

State No.	Active Process	Operation	Process Accessing Critical Region	Process(es) blocked on A	Value of A
0	-	-	-	-	1
1	P2	Test(A)			
2	P1	Test(A)			
3	P2	Increment(A)			
4	P3	Test(A)			

(12/100)

4. (a) Magnetic Tape, Hard Disks, Optical Disks (DVD-R) and Flash Memory are different examples of permanent storage devices. State **one (1)** advantage and **one (1)** disadvantage of each type of storage devices when compared to each other.

Storage Device	Advantage	Disadvantage
(i) Magnetic Tape		
(ii) Hard Disks		
(iii) Optical Disks (DVD-R)		
(iv) Flash Memory		

(8/100)

- (b) A movable head disk drive has 150 tracks, numbered 0 to 149. The Device Manager uses the **SCAN** seek strategy. Given that the read/write head has just serviced track 11, **and is currently at track 5**, determine the seek order for the following track requests, and the total number of tracks traveled by the read/write head:

125, 33, 78, 93, 1, 65, 22

(8/100)

- (c) A Linux system has the following users:

- *aisha*, *paul*, *selva*, *azrin* belonging to the *student* group.
- *soolin* belonging to the *staff* group.
- *root* belongs to the *root* administrator group.

The Linux file system displays the Access Control information in the format *Directory, User, Group, Others*. The following Linux directory listing is given below:

Access Control	Owner	Group	Size	Time Stamp	Filename
drwxrwxr-x	paul	student	4096	Jan 27, 9:00	.
drwxr-xr-x	root	root	4096	Dec 26, 15:30	..
-rwxr-xr-x	selva	student	105930	Feb 2, 16:33	project1
-rw-rw----	aisha	student	3920	Feb 20, 9:10	input.txt
-rw-rw----	azrin	student	61029	Feb 26, 17:39	output.log
-r-xr-x---	root	staff	5910	Dec 28, 12:01	execute-file
-rw-rw-r--	paul	student	1233	Feb 26, 17:55	typescript.out

Determine whether the following actions would be ALLOWED or DENIED:

- soolin* executes file *'execute-file'*.
- selva* executes file *'input.txt'*.

- (iii) *root* creates a file '*backup.log*' in the directory.
- (iv) *paul* accesses the file '*input.txt*' using the executable '*execute-file*'.
- (v) *azrin* creates a new file '*data2.txt*' in the directory.
- (vi) *soolin* reads the contents of '*output.log*'.
- (vii) *selva* deletes the file '*typescript.out*'.
- (viii) *aisha* modifies the file '*input.txt*'.
- (ix) *root* deletes the file '*project1*'.

(9/100)

1. (a) Diberi bahawa ingatan utama terdiri daripada tiga bingkai halaman untuk kegunaan awam dan suatu program meminta halaman-halaman dalam susunan berikut:

a, d, b, a, f, b, e, c, g, f, b, g, c, f, b, d

- (i) Dengan menggunakan algoritma penyingkiran halaman *First-In First-Out* (FIFO), buat analisis surih halaman yang menunjukkan kesalahan halaman dengan asterisk (*). Kemudian kira nisbah kegagalan dan kejayaan.
- (ii) Dengan menggunakan algoritma penyingkiran halaman *Least Recently Used* (LRU), buat analisis surih halaman dan kira nisbah kegagalan dan kejayaan.
- (iii) Manakah algoritma penyingkiran halaman yang lebih baik? Mengapa anda berfikir ia adalah lebih baik?

(17/100)

- (b) Terangkan perbezaan-perbezaan asas antara penyerpihan dalaman dan penyerpihan luaran. Jenis pemecahan manakah yang boleh dikurangkan melalui pemadatan? Terangkan jawapan anda.

(8/100)

2. (a) Terangkan bagaimana anda merekabentuk dan melaksanakan suatu mekanisme untuk membolehkan sistem operasi untuk mengesan proses mana, jika ada, yang mengalami kelaparan.

(5/100)

- (b) Diberi maklumat yang berikut:

Kerja	Masa Ketibaan	Kitaran CPU
A	0	10
B	2	12
C	3	3
D	6	1
E	9	15
F	11	9

Lukiskan satu garis masa bagi setiap algoritma penjadualan berikut.

- (i) *First Come First Served* (FCFS).
- (ii) *Shortest Job Next* (SJN).

- (iii) *Shortest Remaining Time* (SRT).
- (iv) Pusingan robin (gunakan kuantum masa bernilai 5, abaikan konteks pertukaran dan waktu menunggu semula jadi)

(20/100)

3. (a) Komputer telah berkembang daripada seni bina pemproses tunggal menjadi seni bina pemproses berbilang.

- (i) Nyatakan **tiga (3)** jenis konfigurasi pemproses berbilang yang telah dicipta, serta **satu (1)** kelebihan dan **satu (1)** kelemahan untuk setiap konfigurasi:

Konfigurasi	Kelebihan	Kelemahan
I.		
II.		
III.		

- (ii) Haluan terkini adalah untuk pemproses berbilang teras menggantikan pemproses berbilang yang serupa dalam sistem komputer. Jelaskan secara ringkas **satu (1)** isu utama dialami oleh sistem pemproses berbilang teras berbanding dengan sistem pemproses berbilang, dan apakah kaedah yang digunakan untuk mengatasi isu tersebut.

(13/100)

- (b) Kawasan Kritikal mesti dipelihara dalam sistem yang melaksanakan berbagai proses selari. Semafor merupakan suatu cara untuk memelihara capaian kepada kawasan kritikal tersebut.

Semafor A digunakan untuk mencapai kawasan kritikal tertentu, tiga proses P1, P2, dan P3, serta jujukan operasi Semafor Test(A) dan Increment(A) berikut.

Tentukan proses yang mana sedang dilaksanakan dalam kawasan kritikal, proses yang mana disekat, dan nilai A, untuk setiap langkah dalam jujukan operasi berikut dengan mengisikan jadual di bawah.

No. Keadaan	Proses Aktif	Operasi	Proses Mencapai Kawasan Kritikal	Proses yang Disekat pada A	Nilai A
0	-	-	-	-	1
1	P2	Test(A)			
2	P1	Test(A)			
3	P2	Increment(A)			
4	P3	Test(A)			

(12/100)

4. (a) Pita Magnet, Cakera Keras, Cakera Optik (DVD-R) dan Ingatan Flash adalah contoh peranti storan kekal berlainan. Nyatakan **satu (1)** kelebihan dan **satu (1)** kelemahan setiap jenis peranti storan apabila dibanding antara satu sama lain.

Peranti Storán	Kelebihan	Kelemahan
(i) Pita Magnet		
(ii) Cakera Keras		
(iii) Cakera Optik (DVD-R)		
(iv) Ingatan Flash		

(8/100)

- (b) Suatu cakera berkepala bergerak mengandungi 150 runut, bernombor 0 hingga 149. Pengurus Peranti menggunakan strategi jangkau **SCAN**. Diberi kepala baca/tulis baru habis melayan runut 11, **dan terletak di runut 5 pada masa ini**, tentukan turutan jangkauan untuk permintaan runut berikut, serta jumlah runut yang dilalui oleh kepala baca/tulis:

125, 33, 78, 93, 1, 65, 22

(8/100)

- (c) Suatu sistem Linux mempunyai pengguna berikut:

- *aisha*, *paul*, *selva*, *azrin* dalam kumpulan *student*.
- *soolin* dalam kumpulan *staff*.
- *root* terdapat dalam kumpulan pentadbir *root*.

Sistem fail Linux memaparkan maklumat Kawalan Capaian dalam format *Direktori, Pemilik, Kumpulan, Lain-lain*. Senarai direktori Linux berikut diberikan.

Kawalan Capaian	Pemilik	Kumpulan	Saiz	Masa	Nama Fail
drwxrwxr-x	paul	student	4096	Jan 27, 9:00	.
drwxr-xr-x	root	root	4096	Dec 26, 15:30	..
-rwxr-xr-x	selva	student	105930	Feb 2, 16:33	project1
-rw-rw----	aisha	student	3920	Feb 20, 9:10	input.txt
-rw-rw----	azrin	student	61029	Feb 26, 17:39	output.log
-r-xr-x---	root	staff	5910	Dec 28, 12:01	execute-file
-rw-rw-r--	paul	student	1233	Feb 26, 17:55	typescript.out

Tentukan sama ada kelakuan berikut akan **DIBENARKAN** atau **DIHALANG**:

- soolin* melaksanakan fail *'execute-file'*.
- selva* melaksanakan fail *'input.txt'*.

- (iii) *root* mencipta fail '*backup.log*' dalam direktori tersebut.
- (iv) *paul* mencapai fail '*input.txt*' melalui fail boleh-laku '*execute-file*'.
- (v) *azrin* mencipta fail baru '*data2.txt*' dalam direktori tersebut.
- (vi) *soolin* membaca kandungan fail '*typescript.out*'.
- (vii) *selva* menghapus fail '*typescript.out*'.
- (viii) *aisha* mengubahsuai fail '*input.txt*'.
- (ix) *root* menghapus fail '*project1*'.

(9/100)