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UNIVERSITI SAINS MALAYSIA

Supplementary Examinations  
*[Peperiksaan Kursus Semasa Cuti Panjang]*

Academic Session 2007/2008  
*[Sidang Akademik 2007/2008]*

June 2008  
*[Jun 2008]*

**CST131 – Computer Organisation**  
***[Organisasi Komputer]***

Duration : 2 hours  
*[Masa : 2 jam]*

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**INSTRUCTIONS TO CANDIDATE:**

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

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

- Answer **ALL** questions.

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

- Detach **Appendix 1 and 2 (Pages 10 and 11)** from the question paper and use it to answer **Questions 2(b) and 4(c)** respectively.

*[Pisahkan **Lampiran 1 dan 2 (Muka Surat 10 dan 11)** daripada kertas soalan dan gunakannya untuk menjawab **Soalan 2(b) dan 4(c)** masing-masing.]*

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

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

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1. (a) Convert the following numbers to the indicated bases:

$(F415.3)_{16}$  to BCD (binary coded decimal)

(5/100)

- (b) Perform the following arithmetic operation using 2's complement. Determine the status of NZVC bits.

$29 - 62$

(5/100)

- (c) Using Boolean Algebra theorems, simplify the following:

$(X + Y)(\bar{X} + Y + Z)(\bar{X} + Y + \bar{Z})$

(7/100)

- (d) Optimize the following expression using K-map:

$F = \sum m(1, 2, 11, 13, 14, 15) + \sum d(0, 3, 6, 10)$

(8/100)

2. (a) With reference to a flip-flop, use appropriate diagrams to explain the following:

(i) Asynchronous inputs

(ii) Synchronous inputs

(8/100)

- (b) Given the timing diagrams of the inputs A and B in Figure 1(a), draw the output at Q for the flip-flop in Figure 1(b).

**Note:** Use **Appendix 1 on page 10** to write your answer. Detach this page of the appendix from the question paper and attach it to your answer booklet.

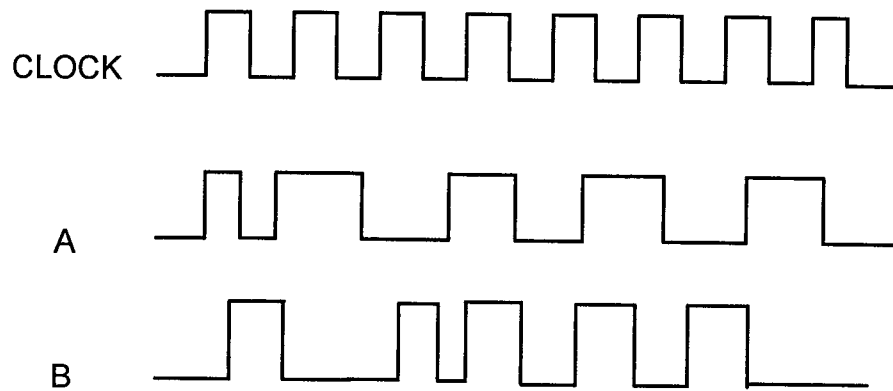


Figure 1(a)

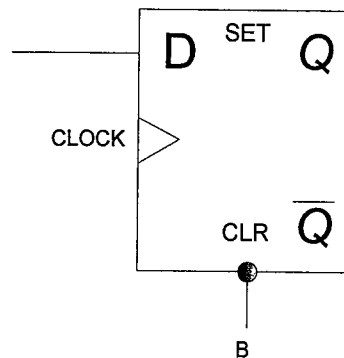


Figure 1(b)

(8/100)

(c) Describe the function of each of the following using schematic diagram and truth table.

- (i) Multiplexor
- (ii) Encoder

(9/100)

3. (a) Briefly compare the following concepts:

- (i) Direct addressing and indirect addressing.
- (ii) Hardwired control unit and microprogrammed control unit.
- (iii) Memory buffer register (MBR) and memory address register (MAR).

(6/100)

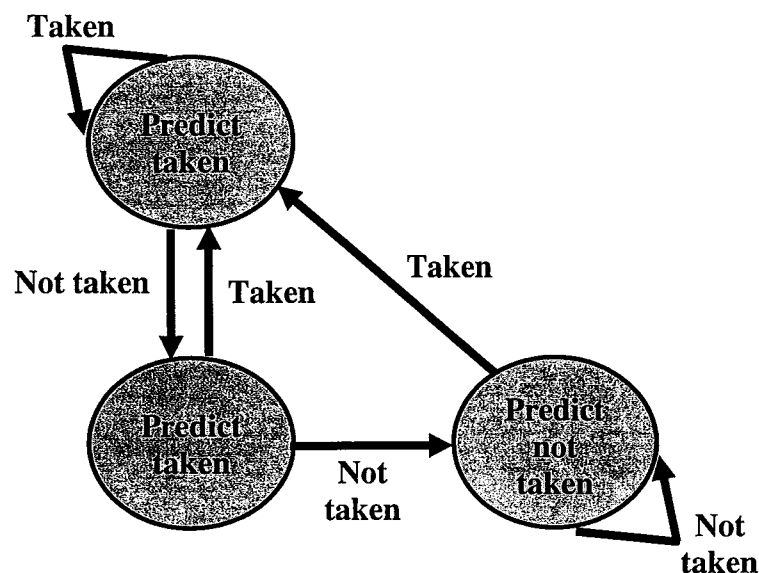
- (b) Assume you need to compute:  $X = (A \times B + C) - (D \div E \times F)$ .
- (i) Write a program to compute X using a three-address machine.
- (ii) Write a program to compute X using a zero-address machine.

The instructions available for use are as follows:

Three-address	Zero-address
MOVE X, Y	PUSH M
ADD X, Y, Z	POP M
SUB X, Y, Z	ADD
MUL X, Y, Z	SUB
DIV X, Y, Z	MUL
	DIV

(8/100)

- (c) Describe the behaviour and the suitability of the branch prediction strategy illustrated by the state diagram below:



(5/100)

- (d) Input signals to the control unit include those from the clock, the instruction register, and flags. In turn, the control unit produces output signals. State and describe **three (3)** destinations of these output signals.

(6/100)

4. (a) Assume a central processing unit (CPU) wishes to issue a READ command to a peripheral device. Also assume that interrupt-driven input/output (I/O) is employed for its I/O operations. List the sequence of hardware events that occur during the READ command from:

(i) the point of view of the I/O module.

(ii) the point of view of the CPU.

(5/100)

- (b) (i) State **two (2)** main differences between the following cache mapping functions: direct mapping and associative mapping.

(ii) Main memory contains 1M words organised into blocks of 64 words. A set associative cache consists of 256 lines (or slots) divided into a number of sets. Each set contains 4 lines. Explain and show the format of main memory addresses.

(10/100)

- (c) A process references five pages (A, B, C, D and E) in the following order:

A B C D A B E A B C D E

Assume that the main memory can store four page frames at any one time. Determine the four pages that are resident in main memory after each page reference change, and the total number of page transfers required upon the conclusion of the sequence of references. Use the least-recently-used (LRU) replacement algorithm.

You may fill in the table provided in the **Appendix 2** to answer this question.

Note: Use **Appendix 2 on page 11** to write your answer. Detach this page of the appendix from the question paper and attach it to your answer booklet.

(10/100)

**KERTAS SOALAN DALAM VERSI BAHASA MALAYSIA**

[CST131]

- 6 -

1. (a) Tukarkan nombor-nombor berikut kepada radiks diberi:

$(F415.3)_{16}$  kepada BCD (*binary coded decimal*)

(5/100)

- (b) Laksanakan operasi aritmetik berikut dengan menggunakan perwakilan pelengkap-2. Tentukan status bit-bit NZVC.

$29 - 62$

(5/100)

- (c) Melalui Algebra Boolean, ringkaskan yang berikut:

$(X + Y)(\bar{X} + Y + Z)(\bar{X} + Y + \bar{Z})$

(7/100)

- (d) Terbitkan ungkapan optimum bagi ungkapan berikut melalui Peta -K:

$F = \sum m(1, 2, 11, 13, 14, 15) + \sum d(0, 3, 6, 10)$

(8/100)

2. (a) Merujuk kepada flip-flop, gunakan rajah-rajah yang berkaitan untuk menjelaskan berikut:

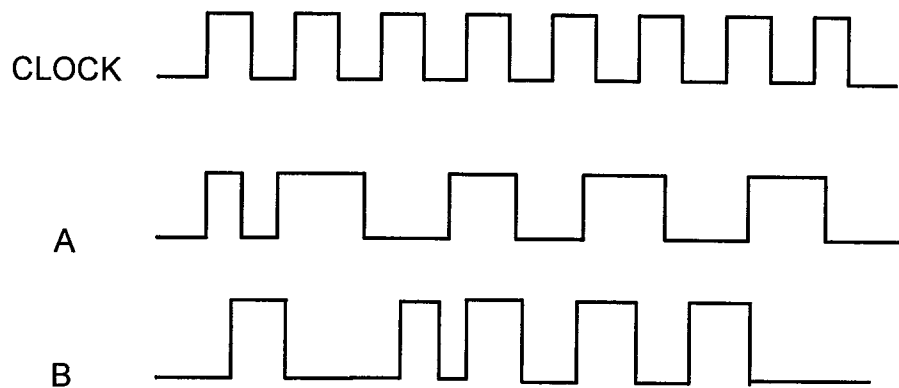
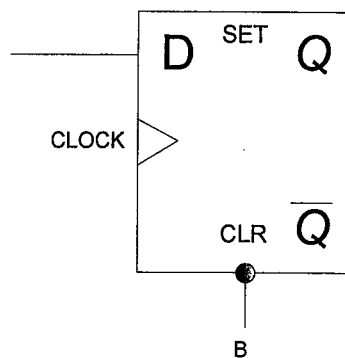
(i) Input-input tak segerak

(ii) Input-input segerak

(8/100)

- (b) Diberi rajah pemasa untuk input-input A dan B di Rajah 1(a), lakarkan output Q bagi flip-flop di Rajah 1(b).

**Catatan:** Gunakan **Lampiran 1 di muka surat 10** untuk menulis jawapan anda. Pisahkan muka surat lampiran ini dari kertas soalan dan kepilkannya kepada buku jawapan.

Rajah 1(a)Rajah 1(b)

(8/100)

(c) Jelaskan fungsi setiap satu yang berikut dengan menggunakan rajah skema dan jadual kebenaran.

- (i) Pemultipleks
- (ii) Pengekod

(9/100)

3. (a) Bandingkan dengan ringkas konsep-konsep berikut:

- (i) Pengalamatan terus dan pengalamatan tak terus.
- (ii) Unit kawalan terdawai keras dan unit kawalan bermikroprogram.
- (iii) Daftar penimbal ingatan (MBR) dan daftar alamat ingatan (MAR).

(6/100)

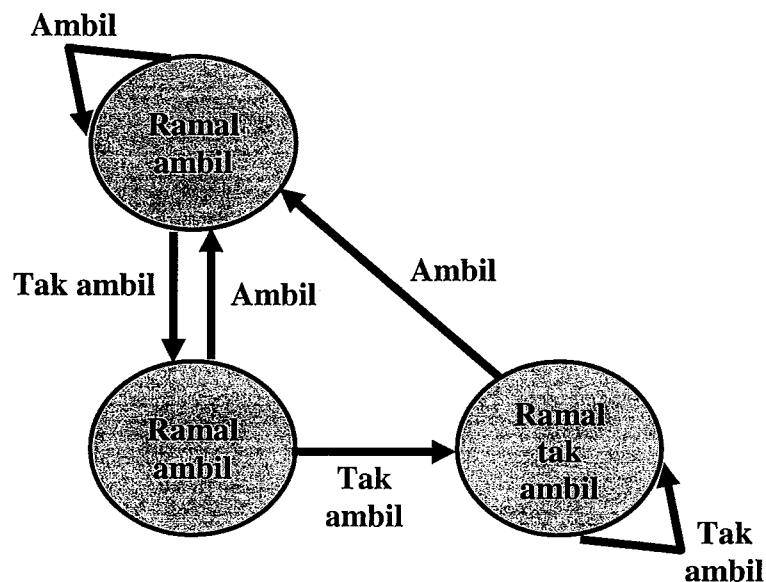
- (b) Andaikan anda ingin mengira:  $X = (A \times B + C) - (D \div E \times F)$ .
- (i) Tulis satu aturcara untuk mengira X dengan menggunakan mesin tiga-alamat.
- (ii) Tulis satu aturcara untuk mengira X dengan menggunakan mesin sifar-alamat.

Arahan-arahan yang boleh digunakan adalah seperti berikut:

Tiga-alamat	Sifar-alamat
MOVE X, Y	PUSH M
ADD X, Y, Z	POP M
SUB X, Y, Z	ADD
MUL X, Y, Z	SUB
DIV X, Y, Z	MUL
	DIV

(8/100)

- (c) Huraikan kelakuan serta kesesuaian strategi ramalan cabang yang ditunjukkan dalam gambar rajah keadaan di bawah:



(5/100)

- (d) Isyarat input kepada unit kawalan antara lain terdiri daripada jam, daftar suruhan, dan bendera. Unit kawalan kemudiannya mengeluarkan isyarat output. Nyatakan dan huraikan **tiga (3)** destinasi isyarat output ini.

(6/100)



4. (a) Andaikan unit pemprosesan pusat (CPU) ingin mengeluarkan arahan READ kepada suatu peranti persisian. Andaikan juga input/output (I/O) berpandukan sampukan digunakan untuk operasi I/O. Senaraikan jujukan peristiwa perkakasan yang berlaku semasa arahan READ berlaku dari:

(i) sudut pandangan modul I/O.

(ii) sudut pandangan CPU.

(5/100)

- (b) (i) Nyatakan **dua (2)** perbezaan utama di antara fungsi-fungsi pemetaan cache berikut: pemetaan terus dan pemetaan berseketu.

(ii) Ingatan utama mengandungi 1M perkataan yang disusun dalam blok-blok 64 perkataan. Satu cache berseketu set terdiri daripada 256 baris (atau slot) yang dibahagikan kepada beberapa set. Setiap set mengandungi 4 baris. Terangkan dan tunjukkan format alamat ingatan utama.

(10/100)

- (c) Suatu proses merujuk lima halaman (A, B, C, D dan E) dalam susunan berikut:

A B C D A B E A B C D E

Andaikan ingatan utama boleh menyimpan empat bingkai halaman pada sesuatu masa. Tetapkan keempat-empat halaman yang menduduki ingatan utama selepas setiap pertukaran rujukan halaman, serta jumlah pindahan halaman yang diperlukan di akhir jujukan rujukan itu. Gunakan algoritma gantian *least-recently-used* (LRU).

Untuk menjawab soalan ini, anda boleh mengisi jadual yang diberi dalam **Lampiran 2**.

Catatan: Gunakan **Lampiran 2 di muka surat 11** untuk menulis jawapan anda. Pisahkan muka surat lampiran ini dari kertas soalan dan kepilkannya kepada buku jawapan.

(10/100)



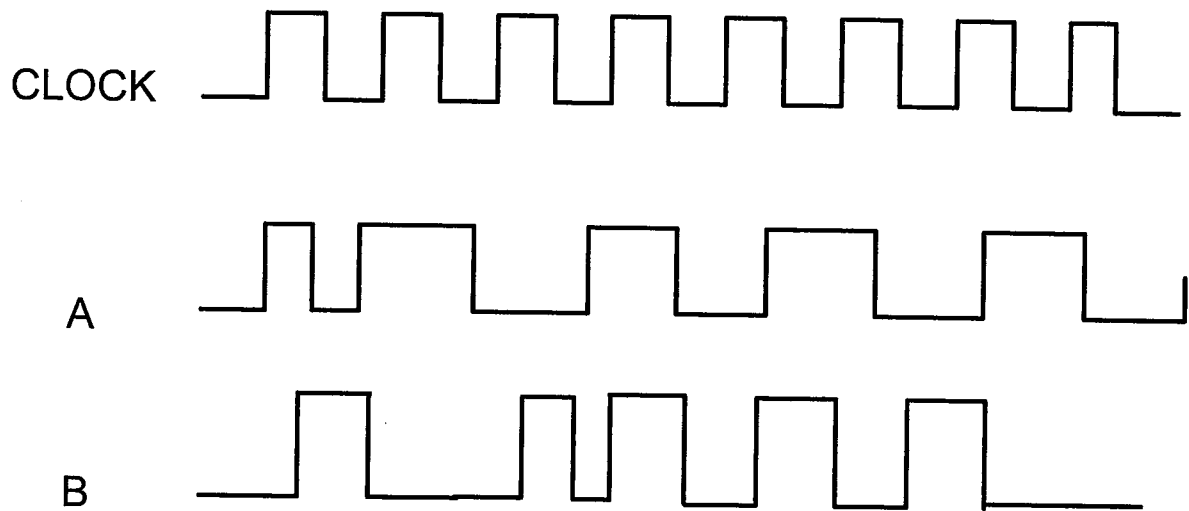
INDEX NO.: \_\_\_\_\_  
[ANGKA GILIRAN:]

[CST131]

- 10 -

Appendix [Lampiran] 1

Question [Soalan] 2(b)





**Appendix [Lampiran] 2**

**Question [Soalan] 4(c)**

<b>Page reference</b> <i>[Rujukan halaman]</i>	<b>Main memory content</b> <i>[Kandungan ingatan utama]</i>	<b>Page transfer?</b> (Yes / No) <i>[Pindahan halaman?</i> <i>(Ya / Tidak)]</i>
A		
B		
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**Total number of page transfers =**  
*[Jumlah pindahan halaman]*