SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

BEU 30063: MICROPROCESSOR & MICROCONTROLLER

TARIKH : 6 JANUARI 2023
MASA : 8.30 AM – 11.30 AM (3 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (1 soalan)
Dokumen sokongan yang disertakan : Appendix

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 80 MARKS

BAHAGIAN A: 80 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan*

QUESTION 1

SOALAN 1

CLO1
C1

(a) An assembly language programme consists of two types of statements: instructions and directives. State the differences between an execution instruction and an assembler directive.

Program bahasa himpunan terdiri daripada dua jenis pernyataan:arahan petunjuk . Nyatakan perbezaan antara arahan pelaksanaan dan arahan penghimpun.

[4 marks]

[*4 markah*]

CLO1
C2

(b) A memory unit is an integral part of any microcomputer, and its primary purpose is to hold instructions and data. The major design goal of a memory unit is to allow it to operate at a speed close to that of a microprocessor.

Unit memori adalah bahagian penting mana-mana mikrokomputer, dan tujuan utamanya adalah untuk memegang arahan dan data. Matlamat utama reka bentuk unit memori adalah untuk membolehkannya beroperasi pada kelajuan yang hampir sama dengan mikropemproses.

i. Discuss the process of a microprocessor executing programmes directly on a hard disk.

Bincangkan proses mikropemproses melaksanakan program secara terus pada cakera keras.

[4 marks]
[*4 markah*]

ii. Explain how the CPU executes software that is stored on the computer's hard disk.

Terangkan bagaimana CPU melaksanakan perisian yang disimpan pada cakera keras komputer.

[2 marks]
[*2 markah*]

CLO1
C3

(c) A machine cycle shows the complete flow of instruction execution so that the instruction execution can be better understood or evaluated for further improvement. Determine the **FOUR (4)** steps of the machine cycle using a suitable figure of instructions execution by the processor.

*Kitaran mesin diperlukan untuk menunjukkan aliran lengkap perlaksanaan arahan supaya perlaksanaan arahan dapat difahami dengan lebih baik atau terdapat sebarang keperluan untuk penambahbaikan.Tentukan **EMPAT (4)** langkah-langkah kitaran mesin menggunakan gambarajah yang sesuai untuk perlaksanaan oleh pemproses.*

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 C2

(a) Programme written in assembly language are made of instructions, running in a program. Convert the statement in **Table A2 (a**) by using the 68000 assembly language instruction.

Aturcara yang ditulis dalam bahasa himpunan terdiri daripada arahan, di dalam sesuatu program. Tukarkan pernyataan berikut dalam ***Jadual A2(a)*** *dengan menggunakan arahan bahasa himpunan 68000.*

Transfer 8-bit data from D1 to D2
Transfer 16-bit data from D3 to address 3000H
Add 32-bit data in D4 and D5
Transfer data 01H in D2

Table A2(a) / *Jadual A2(a)*

[4 marks]

[*4 markah*]

CLO1 C3

(b) Most assemblers assign a value of zero to the starting address of a programme if the programmer does not define this by means of an ORG. Examine the use of ORG in assembly language and the JUMP instruction similarity.

Kebanyakan penghimpun memberikan nilai sifar kepada alamat permulaan program jika pengaturcara tidak mentakrifkan ini melalui ORG. Tentukan penggunaan ORG dalam bahasa himpunan dan persamaannya dengan arahan JUMP.

[6 marks]

[*6 markah*]

CLO1
C4

(c) Microprocessor programming languages can typically be divided into three main types: machine language, assembly language, and high-level language. A machine language programme consists of either binary or hexadecimal op-codes.

Bahasa pengaturcaraan mikropemproses biasanya boleh dibahagikan kepada tiga jenis utama: bahasa mesin, bahasa himpunan dan bahasa tahap tinggi. Program bahasa mesin terdiri daripada kod operasi binari atau perenambelasan.

i. Illustrate the process of translating high-level language into binary machine language.

Gambarkan proses menterjemah bahasa peringkat tinggi ke bahasa mesin binari.

[4 marks]
[*4 markah*]

ii. Differentiate between machine language and assembly language using a suitable example.

Bezakan antara bahasa mesin dan bahasa himpunan menggunakan contoh yang sesuai.

[6 marks]
[*6 markah*]

QUESTION 3

SOALAN 3

CLO1
C2

(a) In order for a processor to perform simple arithmetic operations on any data, the data must first be converted to binary. Convert the statements in **Table A3 (a)** to a flowchart using 68000 assembly language instructions.

*Untuk membolehkan pemproses melakukan operasi aritmetik mudah pada mana-mana data, ia mesti ditukar terlebih dahulu kepada binari. Tukarkan pernyataan berikut dalam **Jadual A3 (a)** ke carta alir dan dengan menggunakan arahan bahasa himpunan 68000.*

1. Set up and initialize to binary zero a storage location for holding the value accumulated during conversion. Set up a pointer to the highest order ASCII digit in the source string.
2. Test the ASCII digit for a value in the range 0 to 9. End of routine if the ASCII digit is not in this range.
3. Subtract 30H from ASCII decimal digit.
4. Multiply accumulated value by 10.
5. Add digit to accumulated value.
6. Increment the pointer to the next digit and continue at step 2.

Table A3 (a) / *Jadual A3 (a)*

[5 marks]

[*5 markah*]

CLO1
C3

(b) A timer is a clock that controls the sequence of an event while counting in fixed intervals of time. Since that a time delay of 1 sec is to be generated and a 12 MHz crystal oscillator is connected to the PIC18F4550.Examine the time delay with a PIC18F4550 timer.

Pemasa ialah jam yang mengawal jujukan sesuatu peristiwa sambil mengira dalam selang masa tetap. DIberi kelewatan masa selama 1 saat akan dijana dan pengayun kristal 12 MHz disambungkan ke PIC18F4550.Periksa kelewatan masa dengan pemasa PIC18F4550.

[5 marks]
[*5 markah*]

CLO1
C4

(c) Von Neumann's architecture was designed by the renowned physicist and mathematician John Von Neumann in the late 1940s, Harvard's architecture was based on the original Harvard Mark I relay-based computer.

Seni bina Von Neumann telah direka oleh ahli fizik dan matematik terkenal John Von Neumann pada akhir 1940-an, dan seni bina Harvard pada adalah berdasarkan komputer berasaskan geganti Harvard Mark I yang asal.

i. Determine the major differences between the two architectures: Von Neumann and Harvard.

Tentukan perbezaan utama antara dua seni bina: Von Neumann dan Harvard.

[4 marks]
[*4 markah*]

ii. Illustrate the architecture of Von Neumann and Harvard.
Gambarkan seni bina von Neumann dan Harvard.

[6 marks]
[*6 markah*]

QUESTION 4

SOALAN 4

CLO1
C3

(a) The architectures of most of the microcontrollers in the PIC18F family are similar. Draw a schematic diagram of input-output interface of the PIC18Fxxxx using an external interrupt. Toggle the LED, which is connected to the PORTC.0 pin, when an external interrupt occurs.

Seni bina kebanyakan mikropengawal lain dalam keluarga PIC18F adalah serupa. Lukis gambarajah skematik antaramuka input-output bagi PIC18Fxxxx menggunakan gangguan luaran. Togol LED, yang disambungkan ke pin PORTC.0, apabila gangguan luaran berlaku.

[4 marks]

[*4 markah*]

CLO1
C4

(b) Basically, a microcomputer executes a user programme that is loaded into its programme memory. Under the control of this program, data is received from external devices (inputs), manipulated, and then sent to external devices (outputs). Determine a block diagram of a temperature control system with a keypad, LCD, and an alarm that is activates when the temperature goes outside the desired range. The temperature readings can be sent to a PC every second for archiving and further processing.

Pada asasnya, komputer mikro melaksanakan program pengguna yang dimuatkan ke dalam memori programnya. Di bawah kawalan program ini, data diterima daripada peranti luaran (input), dimanipulasi, dan kemudian dihantar ke peranti luaran (output). Tentukan rajah blok sistem kawalan suhu dengan papan kekunci, LCD dan penggera yang diaktifkan jika suhu berada di luar julat yang dikehendaki. Bacaan suhu boleh dihantar ke PC setiap saat untuk pengarkiban dan pemprosesan selanjutnya.

[6 marks]

[*6 markah*]

CLO1
C5

(c) **Table A4(c)** shows a programme to check the switch status and perform two tasks. A switch is connected to pin RB2, and this programme uses the BTFSC instruction to check the status. Summarize the task of this programme using a flow chart and mnemonic instructions.

```
        BSF   TRISB,2
        CLRF  TRISD
AGAIN   BTFSC PORTB,2
        BRA   OVER
        MOVLW A'N'
        MOVWF PORTD
        BRA   AGAIN
OVER    MOVLW A'Y'
        MOVWF PORTD
        BRA   AGAIN
```

Table A4 (c) / *Jadual A4 (c)*

Jadual A4 (c) *ialah program untuk menyemak status suis dan melaksanakan dua tugas. Suis disambungkan ke pin RB2, dan program ini menggunakan arahan BTFSC untuk menyemak status suis. Ringkaskan tugas program ini menggunakan carta alir dan arahan mnemonik.*

[10 marks]

[*10 markah*]

SECTION B: 20 MARKS

BAHAGIAN B: 20 MARKAH

INSTRUCTION:

This section consists of **ONE (1)** essay questions. Answer the questions.

ARAHAN:

*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut..*

QUESTION 1

SOALAN 1

CLO1
C4
SP1, SP5

A child care centre is required to install an automatic alarm system based on the PIC18 microcontroller. This system has **FOUR (4)** limit switches, **ONE (1)** light-emitting diode (LED), and **ONE (1)** buzzer. Limit switches will be placed in different parts of the house and connected to pins RB4, RBS, RB6, and RB7 of the microcontroller. These limit switches will be triggered if there are intrusions into the house. LEDs are placed at RD1and buzzers at RA0. During normal conditions (no intrusion), LEDs will blink all the time. When the limit switch is triggered, the buzzer will be switched on. The limit switches are set to ACTIVE LOW. The buzzer and LED are both turned on. As a programmer, you are requested to manage the alarm system. Classify a list of all the system's inputs and outputs in a diagram. Then determine a C programme to execute the task using a Port B Change Interrupt. Any time-delay functions should be ignored. Use **Appendix Al** and **Appendix A2** as reference

*Pusat asuhan kanak-kanak diperlukan untuk memasang sistem penggera automatik berdasarkan mikropengawal PIC18. Sistem ini mempunyai **EMPAT (4)** suis had, **SATU (1)** diod pemancar cahaya (LED), dan **SATU (1)** buzzer. Suis had akan diletakkan di bahagian rumah yang berlainan dan disambungkan ke pin RB4, RBS, RB6, dan RB7 mikropengawal. Suis had ini akan dicetuskan jika terdapat pencerobohan ke dalam rumah. LED diletakkan pada RDl dan buzzer pada RA0. Semasa keadaan biasa (tiada pencerobohan), LED akan berkelip sepanjang masa. Apabila suis had dicetuskan, buzzer akan dihidupkan. Suis had ditetapkan kepada AKTIF RENDAH. Buzzer dan LED kedua-duanya dihidupkan. Sebagai pengaturcara,*

anda diminta untuk menguruskan sistem penggera tersebut. Kelaskan senarai semua input dan output sistem dalam sebuah gambar rajah. Kemudian tentukan program C untuk melakukan tugas tersebut menggunakan Interrupt Perubahan Port B. Sebarang fungsi kelewatan masa harus diabaikan. Gunakan ***Lampiran Al*** *dan* ***Lampiran A2*** *sebagai rujukan.*

[20 marks]
[*20 markah*]

SOALAN TAMAT

APPENDIX A1

9.1 INTCON Registers

The INTCON registers are readable and writable registers, which contain various enable, priority and flag bits.

Note: Interrupt flag bits are set when an interrupt condition occurs, regardless of the state of its corresponding enable bit or the global enable bit. User software should ensure the appropriate interrupt flag bits are clear prior to enabling an interrupt. This feature allows for software polling.

REGISTER 9-1: INTCON: INTERRUPT CONTROL REGISTER

R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-x
GIE/GIEH	PEIE/GIEL	TMR0IE	INT0IE	RBIE	TMR0IF	INT0IF	RBIF(1)
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 7 **GIE/GIEH:** Global Interrupt Enable bit
When IPEN = 0:
1 = Enables all unmasked interrupts
0 = Disables all interrupts
When IPEN = 1:
1 = Enables all high-priority interrupts
0 = Disables all interrupts

bit 6 **PEIE/GIEL:** Peripheral Interrupt Enable bit
When IPEN = 0:
1 = Enables all unmasked peripheral interrupts
0 = Disables all peripheral interrupts
When IPEN = 1:
1 = Enables all low-priority peripheral interrupts
0 = Disables all low-priority peripheral interrupts

bit 5 **TMR0IE:** TMR0 Overflow Interrupt Enable bit
1 = Enables the TMR0 overflow interrupt
0 = Disables the TMR0 overflow interrupt

bit 4 **INT0IE:** INT0 External Interrupt Enable bit
1 = Enables the INT0 external interrupt
0 = Disables the INT0 external interrupt

bit 3 **RBIE:** RB Port Change Interrupt Enable bit
1 = Enables the RB port change interrupt
0 = Disables the RB port change interrupt

bit 2 **TMR0IF:** TMR0 Overflow Interrupt Flag bit
1 = TMR0 register has overflowed (must be cleared in software)
0 = TMR0 register did not overflow

bit 1 **INT0IF:** INT0 External Interrupt Flag bit
1 = The INT0 external interrupt occurred (must be cleared in software)
0 = The INT0 external interrupt did not occur

bit 0 **RBIF:** RB Port Change Interrupt Flag bit(1)
1 = At least one of the RB<7:4> pins changed state (must be cleared in software)
0 = None of the RB<7:4> pins have changed state

Note 1: A mismatch condition will continue to set this bit. Reading PORTB will end the mismatch condition and allow the bit to be cleared.

APPENDIX A2

REGISTER 9-2: INTCON2: INTERRUPT CONTROL REGISTER 2

R/W-1	R/W-1	R/W-1	R/W-1	U-0	R/W-1	U-0	R/W-1
$\overline{\text{RBPU}}$	INTEDG0	INTEDG1	INTEDG2	—	TMR0IP	—	RBIP
bit 7							bit 0

Legend:			
R = Readable bit	W = Writable bit	U = Unimplemented bit, read as '0'	
-n = Value at POR	'1' = Bit is set	'0' = Bit is cleared	x = Bit is unknown

bit 7 **$\overline{\text{RBPU}}$:** PORTB Pull-up Enable bit
1 = All PORTB pull-ups are disabled
0 = PORTB pull-ups are enabled by individual port latch values

bit 6 **INTEDG0:** External Interrupt 0 Edge Select bit
1 = Interrupt on rising edge
0 = Interrupt on falling edge

bit 5 **INTEDG1:** External Interrupt 1 Edge Select bit
1 = Interrupt on rising edge
0 = Interrupt on falling edge

bit 4 **INTEDG2:** External Interrupt 2 Edge Select bit
1 = Interrupt on rising edge
0 = Interrupt on falling edge

bit 3 **Unimplemented:** Read as '0'

bit 2 **TMR0IP:** TMR0 Overflow Interrupt Priority bit
1 = High priority
0 = Low priority

bit 1 **Unimplemented:** Read as '0'

bit 0 **RBIP:** RB Port Change Interrupt Priority bit
1 = High priority
0 = Low priority

Note: Interrupt flag bits are set when an interrupt condition occurs, regardless of the state of its corresponding enable bit or the global enable bit. User software should ensure the appropriate interrupt flag bits are clear prior to enabling an interrupt. This feature allows for software polling.