FINAL EXAMINATION / *PEPERIKSAAN AKHIR*
SEMESTER I - SESSION 2021 / 2022 / *SEMESTER I - SESI 2021 / 2022*
PUSAT PENGAJIAN KERJASAMA

COURSE CODE   : DDWD 1223
KOD KURSUS

COURSE NAME   : COMPUTER ORGANIZATION AND ASSEMBLY LANGUAGE
NAMA KURSUS   *ORGANISASI KOMPUTER DAN BAHASA HIMPUNAN*

YEAR / PROGRAMME : 1 DDWD
TAHUN / PROGRAM

DURATION   : 3 HOURS (INCLUDING SUBMISSION HOUR)
TEMPOH   *3 JAM (TERMASUK MASA PENGHANTARAN)*

DATE   : DECEMBER 2021
TARIKH   *DISEMBER 2021*

INSTRUCTION / *ARAHAN:*

1. The question paper consists of **2 PARTS**: A and B.
    *Kertas soalan terdiri daripada **2 BAHAGIAN**: A dan B.*

2. Answer **ALL** questions and write your answers on the answer sheet.
    *Jawab **SEMUA** soalan dan tulis jawapan anda pada kertas jawapan.*

3. Write a name, matric no., identity card no., course code, course name, section and lecturer name in the upper left corner on the answer sheet.
    Tulis nama, no. matrik, no. kad pengenalan, kod kursus, nama kursus, seksyen dan nama pensyarah di penjuru atas kiri kertas jawapan.

4. Each answer sheet must have a page number written at the bottom right corner.
    Setiap helai kertas jawapan mesti ditulis nombor muka surat pada bahagian bawah penjuru kanan.

5. Answers should be handwriting, neat and clear.
    Jawapan hendaklah ditulis tangan, kemas dan jelas menggunakan huruf cerai.

WARNING / *AMARAN*

Students caught copying / cheating during the examination will be liable for disciplinary actions and the faculty may recommend the student to be expelled from sitting for exam.
Pelajar yang ditangkap meniru / menipu semasa peperiksaan akan dikenakan tindakan disiplin dan pihak fakulti boleh mengesyorkan pelajar diusir dari menduduki peperiksaan.

This examination paper consists of **13** pages including the cover.
*Kertas soalan ini mengandungi **13** muka surat termasuk kulit hadapan.*

ONLINE EXAMINATION RULES AND REGULATIONS
PERATURAN PEPERIKSAAN SECARA DALAM TALIAN

1. Student must carefully listen and follow instructions provided by invigilator.
   Pelajar mesti mendengar dan mengikuti arahan yang diberikan oleh pengawas peperiksaan dengan teliti.

2. Student is allowed to start examination only after confirmation of invigilator if all needed conditions are implemented.
   Pelajar dibenarkan memulakan peperiksaan hanya setelah pengesahan pengawas peperiksaan sekiranya semua syarat yang diperlukan telah dilaksanakan.

3. During all examination session student has to ensure, that he is alone in the room.
   Semasa semua sesi peperiksaan pelajar harus memastikan bahawa dia bersendirian di dalam bilik.

4. During all examination session student is not allowed to use any other devices, applications except other sites permitted by course lecturer.
   Sepanjang sesi peperiksaan pelajar tidak dibenarkan menggunakan peranti dan aplikasi lain kecuali yang dibenarkan oleh pensyarah kursus.

5. After completing the exam student must inform invigilator via the set communication platform (eg. WhatsApp etc.) about completion of exam and after invigilator's confirmation leave examination session.
   Selepas peperiksaan selesai, pelajar mesti memaklumkan kepada pengawas peperiksaan melalui platform komunikasi yang ditetapkan (contoh: Whatsapp dan lain-lain) mengenai peperiksaan yang telah selesai dan meninggalkan sesi peperiksaan selepas mendapat pengesahan daripada pengawas peperiksaan.

6. Any technical issues in submitting answers online have to be informed to respective lecturer within the given 30 minutes. Request for re-examination or appeal will not be entertain if complains are not made by students to their lecturers within the given 30 minutes.
   Sebarang masalah teknikal dalam menghantar jawapan secara dalam talian perlu dimaklumkan kepada pensyarah masing-masing dalam masa 30 minit yang diberikan. Permintaan untuk pemeriksaan semula atau rayuan tidak akan dilayan sekiranya aduan tidak dibuat oleh pelajar kepada pensyarah mereka dalam masa 30 minit yang diberikan.

7. During online examination, the integrity and honesty of the student is also tested. At any circumstances student is not allowed to cheat during examination session. If any kind of cheating behaviour is observed, UTM have a right to follow related terms and provisions stated in the respective Academic Regulations and apply needed measures.
   Semasa peperiksaan dalam talian, integriti dan kejujuran pelajar juga diuji. Walau apa pun keadaan pelajar tidak dibenarkan menipu semasa sesi peperiksaan. Sekiranya terdapat sebarang salah laku, UTM berhak untuk mengikuti terma yang dinyatakan dalam Peraturan Akademik.

Excerpts from online final exam guidelines
Petikan daripada panduan peperiksaan akhir dalam talian
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SECTION A / *BAHAGIAN A*

24 MARKS / *24 MARKAH*

MULTIPLE CHOICE QUESTIONS / *SOALAN ANEKA PILIHAN*

Choose the most appropriate answer. Write your answer in the answer sheet.

Pilih satu jawapan yang tepat. Tulis jawapan anda dalam kertas jawapan.

1. _____ is set when the result of an arithmetic or logical operation generates a negative result.

   _____ *ditetapkan apabila hasil operasi aritmetik atau logik menghasilkan satu hasil negatif.*

   A. Carry Flag / *Membawa Bendera*
   B. Sign Flag / *Tanda Bendera*
   C. Parity Flag / *Bendera Pariti*
   D. Overflow Flag / *Bendera Limpahan*

2. Which of the following general-purpose registers will automatically be used by multiplication and division instruction?

   Yang mana antara daftar kegunaan umum berikut yang akan digunakan secara automatik dengan arahan pendaraban dan pembahagian?

   A. Extended Accumulator Register / *Daftar Pengumpul Diperluas*
   B. Extended Base Register / *Daftar Pangkalan Lanjutan*
   C. Extended Count Register / *Daftar Kiraan Lanjutan*
   D. Extended Data Register / *Daftar Data Diperluas*

3. Which of the following types of memory is commonly known as main memory, is inexpensive but must be refreshed every millisecond to avoid losing its contents?

   Yang manakah jenis memori berikut kebiasaannya dikenali sebagai memori utama, murah tetapi mesti diperbaharui setiap milisaat untuk mengelakkan kehilangan kandungannya?

   A. EPROM
   B. SRAM
   C. CMOS RAM
   D. DRAM

4. Which of the following is **NOT** basic types of operands?

   *Antara berikut yang manakah **BUKAN** jenis operan asas?*

   A. Indirect / *Tidak Langsung*
   B. Immediate / *Segera*
   C. Register / *Daftar*
   D. Memory / *Ingatan*

5. The instruction **MOV CX, [BX] + 10** represents the following addressing mode:

   *Arahan **MOV CX, [BX] + 10** mewakili mod pengalamatan berikut:*

   A. Based Relative / *Berasaskan Relatif*

   B. Indexed Relative / *Relatif Berindeks*

   C. Based Indexed / *Berasaskan Indeks*

   D. Register Indirect / *Mendaftar Tidak Langsung*

6. Part of the operating system is usually stored in ROM so that it can be used to boot up the computer. ROM is used rather than RAM because _____?

   Sebahagian daripada sistem pengoperasian disimpan dalam ROM supaya ia boleh digunakan untuk memulakan (boot) komputer. ROM digunakan berbanding RAM kerana _____?

   A. ROM chips are faster than RAM / *cip ROM lebih laju dari cip RAM*

   B. ROM chips are not volatile / *cip ROM tidak meruap*

   C. ROM chips are cheaper than RAM chips / *cip ROM lebih murah dari cip RAM*

   D. None of the above / *tiada jawapan di atas*

7. Which of the following is the largest disk space?

   Antara berikut yang manakah adalah ruang cakera yang paling besar?

   A. Terabyte   C. Yottabyte

   B. Zettabyte   D. Exabyte

8. Any computer must atleast consist of _____.

   Mana-mana komputer mesti terdiri daripada _____.

   A. Data Bus / *Bas Data*   C. Control Bus / *Bas Kawalan*

   B. Address Bus / *Alamat Bas*   D. All of the above / *Semua di atas*

9. Which of the following is **NOT** a 16-bit segment register?

   *Antara berikut yang manakah **BUKAN** daftar segmen 16-bit?*

   A. CS   C. FS

   B. SP   D. GS

10. Cache memory refers to _____.

    Ingatan cache merujuk kepada _____.

    A. cheap memory that can be plugged into the motherboard to expand main memory

    memori murah yang boleh diapasang pada papan induk untuk memperluaskan ingatan utama

    B. fast memory present on the processor chip that is used to store newly accessed data

    memori pantas pada cip pemproses yang digunakan untuk menyimpan data yang baru dicapai

    C. a reserved portion of main memory used to save important data

    satu bahagian simpanan ingatan utama yang digunakan untuk menyimpan data penting

    D. a special area of memory on the chip that is used to save frequently used constants

    satu kawasan khas ingatan pada cip yang digunakan untuk menyimpan pemalar yang kerap digunakan

11. Choose **INVALID** instruction based on the following data definition:

    *Pilih arahan yang **TIDAK SAH** berdasarkan pentakrifan data barikut:*

    ```
    .data
    arrayOne    WORD    2134h, 1230h, 3210h
    arrayTwo    DWORD   12, 10, 23, 49
    ```

    A. mov ax, arrayOne + 2   C. mov ax, arrayTwo + 4

    B. mov ax, arrayOne [4]   D. mov eax, arrayTwo

12. Number of the times the instruction sequence below will loop before coming out of loop is

    Bilangan kali jujukan arahan di bawah akan melakukan gelung sebelum keluar daripadanya adalah

    ```
            mov    al, 00h
    A2:     inc    al
            jnz    A2
    ```

    A. 00   C. 255

    B. 01   D. 256

13. What is the effect of the following instruction?
Apakah kesan dari arahan berikut?

```
add bx, 120
```

A. Adds the value of 120 to the address of bx and stores 120 in that address
Menambah nilai 120 ke alamat bx dan simpan nilai 120 pada alamat itu

B. Adds the value of 120 to the value of bx and stores it in bx
Menambah nilai 120 ke dalam bx dan simpai nilai pada bx

C. Finds the memory location 120 and adds that content to that bx
Mencari lokasi ingatan 120 dan tambahkan kandungannya kepada bx

D. None of the above
Tiada jawapan di atas

14. The bus that connects the main processor and the hardware devices is called a _____.
Bas yang menyambungkan pemproses utama dan peranti perkakasan dipanggil _____.

A. system bus / *bas sistem* C. PCI bus / *bas PCI*
B. local bus / *bas tempatan* D. expansion bus / *bas pengembangan*

15. The condition of Zero Flag is set to 1 to indicate _____.
Keadaan Bendera Sifar disetkan ke 1 untuk menunjukkan _____.

A. the operation has resulted in an error / *operasi telah mengakibatkan ralat*
B. the operation requires an interrupt call / *operasi memerlukan panggilan sampukan*
C. the result of the operation is zero / *hasil operasi adalah sifar*
D. there is no empty register available / *tiada daftar yang kosong*

16. **.data** directive is used to _____.
*Direktif **.data** digunakan untuk _____.*

A. indicate the ending of the data section / *menunjukkan seksyen data berakhir*
B. indicate the beginning of the data section / *menunjukkan permulaan seksyen data*
C. indicate all the source operands / *menunjukkan semua kendalian sumber*
D. initialize the operands / *memberi nilai awalan kepada kendalian*

SECTION B / *BAHAGIAN B*

76 MARKS / *76 MARKAH*

SUBJECTIVE QUESTIONS / *SOALAN SUBJEKTIF*

Answer all questions and write your answer in the answer sheet.

Jawab semua soalan dan tulis jawapan anda dalam kertas jawapan.

1. Perform the following addition and show how the bits (CF, ZF, AF, PF, OF, and SF) of the flag register is affected by the following operations.

    Lakukan penambahan berikut dan tunjukkan bagaimana bit (CF, ZF, AF, PF, OF, dan SF) dari daftar bendera dipengaruhi oleh operasi berikut. **[6 M]**

    C4BFh + 31F8h

    CF = _____ PF = _____ AF = _____ ZF = _____ SF = _____ OF = _____

2. Given two decimal numbers, A and B. Suppose A = 34 and B = 189. Convert each of them into 8-bit binary numbers and then show how does a computer performs B - A operation. Show how the flags register is affected after the operation.

    Diberi dua nombor perpuluhan, A dan B. Andaikan A = 34 dan B = 189. Tukarkan masing-masing menjadi nombor perduaan 8-bit dan kemudian tunjukkan bagaimana komputer melakukan operasi B - A. Tunjukkan bagaimana daftar bendera terjejas selepas operasi. **[6 M]**

    B – A

    CF = _____ PF = _____ AF = _____ ZF = _____ SF = _____ OF = _____

3. What is equivalent of **-110_{10}** in 8-bit two's complement representation? Show your working?

    Apakah yang setara dengan **-110_{10}** *dalam perwakilan pelengkap dua dalam 8-bit? Tunjukkan kerja anda?* **[4 M]**

4. What is equivalent of **$E5C6_{16}$** into two's complement hexadecimal? Show your working?

    Apakah yang setara dengan **$E5C6_{16}$** *menjadi heksadesimal pelengkap dua? Tunjukkan kerja anda?*

    [4 M]
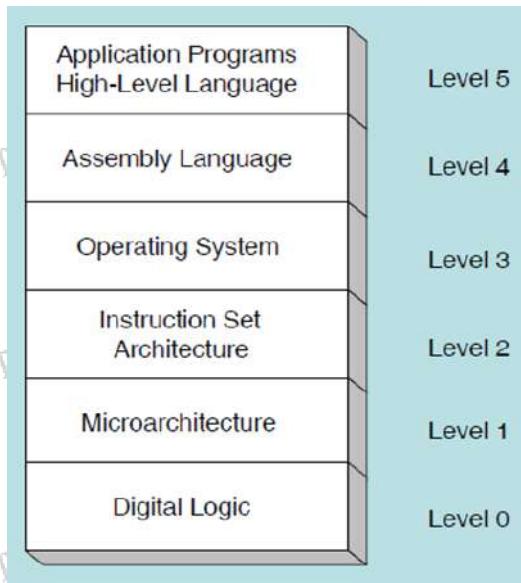
Figure 1: Virtual Machine Levels / *Rajah 1: Tahap Mesin Maya*

5. Explain each level of virtual machine levels in **Figure 1**?

   Terangkan setiap tahap mesin maya dalam Rajah 1? [6 M]

6. Show the content of the individual bytes allocated in memory (in hexadecimal) for the following data declarations. Assume a computer with 32-bit address bus, and that the physical address of myArray is **00909000h**. What are the addresses of **bigArray**, **pArray**, and **message**? What is the **total number** of allocated bytes?

   Note: ASCII Table attached in APPENDIX A.

   Tunjukkan kandungan setiap bait yang diperuntukkan dalam ingatan (dalam heksadesimal) untuk pengisytiharan data berikut. Andaikan komputer yang mempunyai 32-bit bas alamat, dan alamat fizikal myArray adalah 00909000h. Apakah alamat bigArray, pArray, dan message? Berapakah jumlah bait yang diperuntukkan?

   Nota: Jadual ASCII dilampirkan pada APPENDIX A. [12 M]

```
.data
    myArray         WORD        50h, 20h, 80h
    ALIGN 4
    bigArray        DWORD       2 DUP("Y")
    pArray          DWORD       bigArray
    message         BYTE        "I Love U"
```

Sample of Memory Layout:

LABEL	OFFSET	CONTENT	MEMORY (HEX)
myArray	00909000	10h	10

Address of **myArray** / *Alamat **myArray*** : _____

Address of **bigArray** / *Alamat **bigArray*** : _____

Address of **pArray** / *Alamat **pArray*** : _____

Address of **message** / *Alamat **message*** : _____

Total number of bytes allocated / *Jumlah bait yang diperuntukkan* : _____

7. Show the value of the flag bits after the following instructions are executed:
    Tunjukkan nilai bit bendera selepas arahan berikut dilaksanakan: **[3 M]**

```
mov    eax, 70
mov    ebx, 110
cmp    eax, ebx
```

ZF = _____   CF = _____

8. Indicate the content of register AL and DL (in hex value) and status flag of CF after the execution of the following program fragment.
    Nyatakan kandungan daftar AL dan DL (dalam nilai hex) dan bendera status CF setelah pelaksanaan fragmen aturcara berikut. **[6 M]**

```
mov    dx, -80
sar    dl, 1
mov    al, 6Bh
shr    al, 1
shl    al, 3
```

AL = _____   BL = _____   CF = _____

9. Show the value of the flag bits after the following instructions are executed:

   Tunjukkan nilai bit bendera selepas arahan berikut dilaksanakan: **[5 M]**

```
mov    al, 00101010b
mov    bl, 00010010b
test   al, 00001001b      ;  ZF = _____
test   bl, 00001001b      ;  ZF = _____
add    al, bl             ;  ZF = _____    PF = _____
sub    al, 100d           ;  CF = _____
```

10. Refer to the following fragments below:

    Rujuk keratan aturcara berikut dibawah:

```
.data
        Data1      BYTE    12d, 32d, 40d, 100d, 5d
        Data2      WORD    1D20h, 98A2h, 650h, 12h, 328Ch
        Data3      DWORD   40000h, 50000h, 30000h
        Sum        WORD    ?
.code
main PROC
        mov    esi, 2
        mov    al,  Value1[esi]          ;      ............[1]
        mov    bx,  Value2[esi * 2]      ;      ............[2]
        mov    ecx, Value3[esi * 4]      ;      ............[3]
```

    Suppose the address of the data segment starts at address **00090900h**. What is the effective address of the source operand for instruction labeled [1], [2], [3]? Show your calculation.

    *Andaikan alamat segmen data bermula pada alamat **00090900h**. Apakah alamat efektif bagi kendalian sumber bagi arahan [1], [2], dan [3]? Tunjukkan pengiraan anda.* **[3 M]**

11. Refer to the following data declaration:

    Rujuk kepada pengisytiharaan data berikut:

```
.data
        B1     WORD    5 DUP(4 DUP(?)), 0, 0, 0
        B2     DWORD   2, 4, 6, 8
        MSG    BYTE    "Final Exam", 0
        X1     LABEL   DWORD
        X2     LABEL   WORD
        ARR    BYTE    00h, 20h, 10h, 30h
```

    What will be the content of register (in hex) if the following instruction is executed?

    Apakah kandungan daftar (dalam heksa) jika arahan berikut dilaksanakan. **[6 M]**

i)   mov ecx, LENGTHOF B1   ;   ECX = _____

ii)   mov ecx, SIZEOF MSG   ;   ECX = _____

iii) mov ecx, TYPE B2   ;   ECX = _____

iv) mov eax, X1   ;   EAX = _____

v)   mov cx, X2   ;   CX = _____

vi) mov dl, ARR   ;   DL = _____

12.   Implement the following C++ Programming in assembly language. Your program **MUST** use **LOOP** and **JE** instructions. Your program should follow exactly as the sample output, do use new line instructions in assembly language to replace endl that have been used in the following C++ Programming.

*Laksanakan Pengaturcaraan C++ berikut dalam bahasa perhimpunan. Program anda **MESTI** menggunakan arahan **LOOP** dan **JE**. Program anda harus mengikuti betul-betul seperti contoh output, gunakan arahan baris baru dalam bahasa himpunan untuk menggantikan endl yang telah digunakan dalam Pengaturcaraan C++ berikut.*   **[15 M]**

```cpp
#include <iostream>
using namespace std;

int main(){
        int num1, num2;

        for (int i=0; i < 3; i++){

                cout << "masukkan nombor 1 : ";
                cin >> num1;
                cout << "masukkan nombor 2 : ";
                cin >> num2;

                if (num1 == num2){
                        cout << "num1 and num2 is equal" << endl;

                        if(num1 == 100){
                                cout << "num1 is 100" << endl;
                        }else{
                                cout << "num1 is unknown" << endl;
                        }

                }else {
                        cout << "not equal" << endl;
                }
                cout << endl;
        }
}
```

Sample output should be same as below:
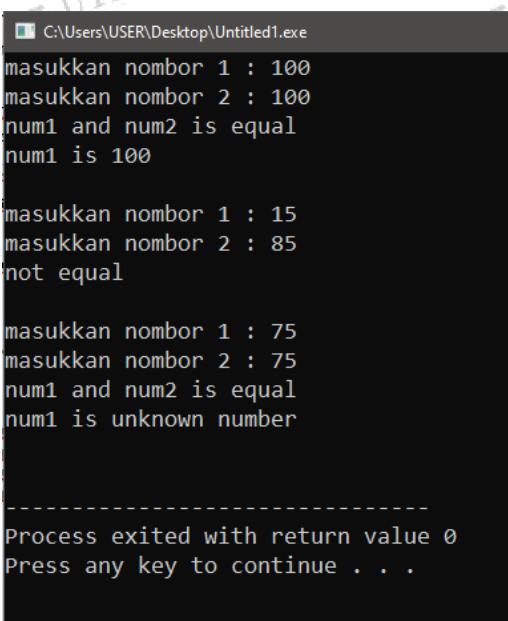
```
C:\Users\USER\Desktop\Untitled1.exe
masukkan nombor 1 : 100
masukkan nombor 2 : 100
num1 and num2 is equal
num1 is 100

masukkan nombor 1 : 15
masukkan nombor 2 : 85
not equal

masukkan nombor 1 : 75
masukkan nombor 2 : 75
num1 and num2 is equal
num1 is unknown number


--------------------------------
Process exited with return value 0
Press any key to continue . . .
```

END OF QUESTIONS / *SOALAN TAMAT*

APPENDIX A

ASCII TABLE / *JADUAL ASCII*

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	–	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C		
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□