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 : JUNE / JULY 2022
TARIKH   *JUN / JULAI 2022*

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.

This examination paper consists of **11** pages including the cover.
*Kertas soalan ini mengandungi **11** 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 invigilators 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
Universiti Teknologi Malaysia

SECTION A / *BAHAGIAN A*

70 MARKS / *70 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. What is equivalent of **-220_{10}** in 8-bit two's complement representation? Show your working?

    *Apakah yang setara dengan **-220_{10}** dalam perwakilan pelengkap dua 8-bit? Tunjukkan kerja anda?*

    [4 M]

2. What is equivalent of **$A11D_{16}$** into two's complement hexadecimal? Show your working?

    *Apakah yang setara dengan **$A11D_{16}$** menjadi heksadesimal pelengkap dua? Tunjukkan kerja anda?*

    [4 M]

3. 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]**

    D145h + EF12h

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

4. Given two decimal numbers, A and B. Suppose A = 11 and B = 169. 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 = 11 dan B = 169. 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

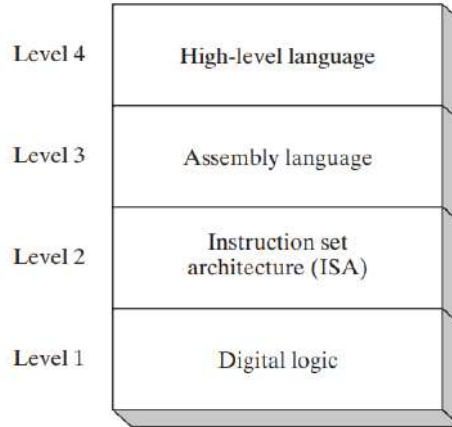   CF = _____   PF = _____   AF = _____   ZF = _____   SF = _____   OF = _____

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**?* [4 M]

6. What the difference between **DRAM** and **SRAM** memory?

   *Apakah perbezaan antara memori **DRAM** and **SRAM**?* [4 M]

7. Refer to the following data declaration:

   Rujuk kepada pengisytiharaan data berikut:

   ```
   .data
           Arr1        SBYTE       -10, -20, -30, -40
           Arr2        WORD        100h, 400h, 700h
           Arr3        SWORD       -235h, -8930
           Arr4        DWORD       50000, 60000, 70000, 80000
   ```

   For each of the following statements, state whether the instruction is valid or not valid.

   Bagi setiap pernyataan berikut, nyatakan sama ada arahan itu sah atau tidak. [5 M]

   i)   mov   ax, Arr1   =

   ii)   mov   ax, Arr2   =

   iii) movzx   eax, Arr4   =

   iv)   movsx   eax, Arr3   =

   v)   mov   ds, ax   =

   vi)   mov   ds, 2000h   =

   vii) movzx   Arr2, al   =

viii) cmp   Arr1, Arr2   =

ix) add   Arr1, 1   =

x)   sub   eax, 1   =

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 program berikut. **[6 M]**

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

AL = _____   DL = _____   CF = _____

9. 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, 90
mov    ebx, 200
cmp    eax, ebx
```

ZF = _____   CF = _____

10. 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 = _____
```

11. Refer to the following fragments:

Rujuk keratan aturcara berikut:

```
        .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,  Data1[esi]          ;    ...........[1]
                mov     bx,  Data2[esi * 2] ;     ...........[2]
                mov     ecx, Data3[esi * 4] ;     ...........[3]
```

Suppose the address of the data segment starts at address **00070700h**. What is the effective address of the source operand for instruction labeled [1], [2], and [3]? Show your calculation.

*Andaikan alamat segmen data bermula pada alamat **00070700h**. Apakah alamat efektif bagi kendalian sumber bagi arahan [1], [2], dan [3]? Tunjukkan pengiraan anda.*   **[3 M]**

12. 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 Val1 is **00707000h**.

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 Val1 adalah **00707000h**.*

Nota: Jadual ASCII dilampirkan pada APPENDIX A.   **[20 M]**

```
        .data
                Val1        WORD        1224h, 323h
                Align 4
                Val2        SDWORD      -9856d, +7851
                Name1       LABEL       DWORD
                Name2       LABEL       WORD
                Val3        BYTE        2 DUP ("CY"), 2 DUP ("b")
                Key         EQU         <"Hello World", 0>
                Val4        BYTE        2 DUP (3 DUP (2 DUP (?))), 10h, 12h
                Display     BYTE        Key
                Array       DWORD       Val3
```

Sample of memory layout / *Contoh susun atur memori*:

LABEL	OFFSET	CONTENT	MEMORY (HEX)
Val1	00707000	10h	10

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

Apakah kandungan daftar (dalam heksa) jika arahan berikut dilaksanakan.

i)	mov	eax, TYPE Val2	;	EAX = _____
ii)	mov	eax, LENGTHOF Val4	;	EAX = _____
iii)	mov	eax, SIZEOF Val3	;	EAX = _____
iv)	mov	eax, OFFSET Val1	;	EAX = _____
v)	mov	eax, OFFSET Val2	;	EAX = _____
vi)	mov	eax, OFFSET Val3	;	EAX = _____
vii)	mov	eax, OFFSET Val4	;	EAX = _____
viii)	mov	eax, OFFSET Display	;	EAX = _____
ix)	mov	eax, OFFSET Array	;	EAX = _____
x)	mov	eax, Name1	;	EAX = _____
xi)	mov	ax, Name2	;	AX = _____
xii)	mov	al, BYTE PTR Val2	;	AL = _____
xiii)	mov	eax, DWORD PTR Val3	;	EAX = _____
xiv)	mov	ax, WORD PTR Display	;	AX = _____

SECTION B / *BAHAGIAN B*

30 MARKS / *30 MARKAH*

PROGRAMMING / *PENGATURCARAAN*

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

Jawab semua soalan dan tulis jawapan anda dalam kertas jawapan

Programming 1 / *Pengaturcaraan 1*

Create a program to solve the arithmetic expression below:

Cipta satu atur cara untuk menyelesaikan ungkapan aritmetik di bawah:

```
Total = (-Value1 - (Value2 + Value3)) * 5 + (Value4 / Value5) - 1
```

You should use the following information for your code:

Anda harus menggunakan maklumat berikut untuk kod anda:

- Declare Value1 with 32-bit unsigned integer variable and initialize it with 100 decimal value.

  Isytiharkan Nilai1 dengan pembolehubah integer tidak bertanda 32-bit dan mulakannya dengan nilai perpuluhan 100.

- Declare Value2 with 32-bit unsigned integer variable and initialize it with 200 decimal value.

  Isytiharkan Nilai2 dengan pembolehubah integer tidak bertanda 32-bit dan mulakannya dengan nilai perpuluhan 200.

- Declare Value3 with 32-bit unsigned integer variable and initialize it with 77 decimal value.

  Isytiharkan Nilai3 dengan pembolehubah integer tidak bertanda 32-bit dan mulakannya dengan nilai perpuluhan 77.

- Declare Value4 with 32-bit unsigned integer variable and initialize it with 100 decimal value.

  Isytiharkan Nilai4 dengan pembolehubah integer tidak bertanda 32-bit dan mulakannya dengan nilai perpuluhan 100.

- Declare Value5 with 32-bit unsigned integer variable and initialize it with 5 decimal value.

  Isytiharkan Nilai5 dengan pembolehubah integer tidak bertanda 32-bit dan mulakannya dengan nilai perpuluhan 5.

[15 M]

Programming 2 / *Pengaturcaraan 2*

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
[*] Untitled1.cpp
1    #include <iostream>
2    using namespace std;
3
4    int main(){
5        int value1, value2;
6
7        for (int i=0; i < 5; i++){
8
9            cout << "Enter value 1 : ";
10           cin >> value1;
11           cout << "Enter value 2 : ";
12           cin >> value2;
13
14           if (value1 == value2){
15               cout << "value1 and value2 is equal" << endl;
16
17               if(value1 == 15){
18                   cout << "value1 is 15" << endl;
19               }else{
20                   cout << "value1 is not 15" << endl;
21               }
22
23           }else {
24               cout << "not equal" << endl;
25           }
26           cout << endl;
27       }
28   }
29
```

Sample output should be same as below:

Output sampel hendaklah sama seperti di bawah:

```
C:\Users\USER\Desktop\Untitled1.exe

Enter value 1 : 45
Enter value 2 : 45
value1 and value2 is equal
value1 is not 15

Enter value 1 : 20
Enter value 2 : 35
not equal

Enter value 1 : 15
Enter value 2 : 10
not equal

Enter value 1 : 15
Enter value 2 : 15
value1 and value2 is equal
value1 is 15

Enter value 1 : 20
Enter value 2 : 21
not equal


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

END OF QUESTIONS / *SOALAN TAMAT*

DDWD 1223

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	□