

# 程序代写代做 CS编程辅导

## COMP2300/6300 Final Exam 2019

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Reading time: 15 minutes

Writing time: 180 minutes

**Make sure you read each question carefully.** Some words have footnotes<sup>1</sup> to clarify what they mean in the context of the question.

Questions are not equally weighted, and the size of the answer box is not necessarily related to the length of the expected answer or the number of marks given for the question.

All answers must be written in the boxes provided in this booklet. You will be provided with scrap paper for working, but only the answers written in this booklet will be marked. Do not remove this booklet from the examination room. There is additional space at the end of the booklet in case the boxes provided are insufficient. If you use these extra pages, make sure you clearly label which question the answer refers to.

Greater marks will be awarded for answers that are short and specific rather than long, vague, or rambling. Marks may be deducted for providing information that is irrelevant to a question. If a question ask for you to “explain your answer”, make sure both your *answer* (e.g. yes/no) and your *explanation* are clearly indicated. If a question has several parts, you may answer the later parts even if you cannot answer the earlier ones.

Where you are asked to write assembly code programs, marks will not be deducted for minor syntax errors.

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<sup>1</sup>like this one!

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*For examiner use*

## Question 1 Logic, Bits, and Instructions (25 marks total)

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### Part 1 2 marks

Suppose the following assembly code is executed. What will the final value of **r0** be? Choose your answer from the options below.



```
mov r0, 0b101
mov r1, 0b000
lsl r1, 3
orr r0, r0, r1
```

What will the final value of **r0** be? Choose your answer from the options below.

- 0b10101111
- 0b11101101
- 0b11111111
- 0b10101101

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### Part 2 3 marks

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#### LSR (register)

Logical Shift Right (register) shifts a register value right by a variable number of bits, shifting in zeros, and writes the result to the destination register. The variable number of bits is read from the bottom byte of a register. It can optionally update the condition flags based on the result.

#### Encoding T1

All versions of the Thumb instruction set.

LSRS <Rdn>, <Rm>

Outside IT block.

LSR<c> <Rdn>, <Rm>

Inside IT block.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	0	0	0	1	1	Rm					Rdn

d = UInt(Rdn); n = UInt(Rdn); m = UInt(Rm); setflags = !InITBlock();

Using the T1 encoding for the **lsr** instruction as shown above, fill out (in the boxes provided) the 16-bit bit pattern (0s and 1s) which represents the following line of assembly code:

```
lsr r1, r6
```

Answer:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

**Part 3 5 marks**

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What will the values of the NZCV status bits be after these instructions are executed? What value will be in `r0`? Fill in your answers in the spaces below.

```
mov r0, 0xffff
mov r1, 0x10
adds r0, r0, r1
```



Answer:

- N:
- Z:
- C:
- V:
- `r0`:

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**Part 4 5 marks**

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You want to implement a pseudo-instruction called `not` that will invert a register's value in a bit-wise manner. The pseudo instruction's behaviour will be defined as follows:

```
not Rn, Rm
```

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What set of instructions could be used to implement `not`? Try to use the fewest instructions possible, and note down if any extra registers, other than `Rn` and `Rm` mentioned above, are needed.

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**Part 5 2 marks**

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You're responsible for designing a new CPU that only uses only NOR gates (defined as follows):



Q

A	B	Q
F	F	T
F	T	F
T	F	F
T	T	F

Draw diagrams to ( ) is equivalent to a logical NOT gate using only NOR gates.

Answer:

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**Part 6 3 marks**

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Draw diagrams to define a circuit that is equivalent to a logical OR gate using only NOR gates (as defined above).

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Answer:

**Part 7 5 marks****程序代写代做 CS编程辅导**

What are flip-flop circuits, and how could they be used as part of a CPU? Be as specific as you can. You may include pictures/diagrams in your answer.



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**Question 2 Control Structures and Functions (25 marks total)**

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**Part 1 2.5 marks**

Suppose a function `f` follows the ARM Architecture Procedure Call Standards (AAPCS). `f` takes three parameters and returns a value. After `f` completes, in which of the following places will the return value be found?



Answer:

- in `r0`
- in `r1`
- in `r2`
- in `r12`
- in `pc`
- in `fp`
- on the stack
- in the `.data` section

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**Part 2 2.5 marks****程序代写代做 CS编程辅导**

Suppose the following assembly code has stored the values 32, 7, 84, and 128 on the stack.

```
mov    r3, #32
stmdb  sp!, {r3}
mov    r3, #7
stmdb  sp!, {r3}
mov    r3, #84
stmdb  sp!, {r3}
mov    r3, #128
stmdb  sp!, {r3}
```



Which of the following instructions will load the value 84 into **r3**?

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Answer:

- **ldr r3, [sp]**
- **ldr r3, [sp, #4]**
- **ldr r3, [sp, #8]**
- **ldr r3, [sp, #12]**
- **ldr r3, [sp, #16]**

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**Part 3 5 marks****程序代写代做 CS编程辅导**

Implement the following “for”-loop in ARMv7 assembly code.

```
int acc = 0;  
for (int i = 0;  
     acc = acc +
```



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**Part 4 10 marks****程序代写代做 CS编程辅导**

Write a **recursive** assembly function (starting at the label **pow**) which calculates the power function:



$$\text{pow}(x, y) = x^y \quad (1)$$

for positive integers  $x$  and  $y$ .

Add comments to explain your code. Parameters are passed into the function and where the result will be stored. You can assume that the result will fit into a 32-bit unsigned integer, so you do not need to handle numerical overflow in your function.

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**Part 5 5 marks****程序代写代做 CS编程辅导**

The output of our *pow* function is likely to overflow, for instance, when calculating *pow*(2, 33). If you were given the task of optimising the *pow* function to express numbers that are as large as possible what changes would you make? Explain your answer.

Be as specific as you can. You may include pictures/diagrams in your answer.



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**Question 3 Asynchronism & data (25 marks total)**

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**Part 1 2 marks**

Select the **best** definition of “mutual exclusion” below.

Answer:

- 
- A method to ensure that no process can modify it.
  - A method to ensure that only one program can access a shared resource at a time.
  - A method to determine whether two programs are accessing memory at once.
  - A method to exclude programs from accessing the private memory of other programs.
  - A method to stop multiple programs from changing CPU registers.
  - A method for saving data in between context switches.

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**Part 2 3 marks**

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Of the program tasks below, select the **three** that are **most likely** to be accomplished with interrupts in a disco board program. Your first three selections will be considered to be your answer.

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Answer:

- 
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- Turning on an LED.
  - Branching based on the value of a register.
  - Sending data over a network.
  - Receiving data over a network.
  - Calculating the frequency of a musical pitch.
  - Scheduling a regularly timed event.
  - Playing MIDI notes.
  - Loading data from memory.
  - Setting peripheral control registers.
  - Responding to unexpected errors.

**Part 3 5 marks****程序代写代做 CS编程辅导**

You've been asked to write a simple encryption program to obscure **lower-case text data** on a discoboard by shifting each letter **one position backwards** (e.g., "b" should be encoded as "a").

The program should **ignore** **non, spaces or upper-case letters**. The letter "a" should be wrapped to "z".

Your first task is to **apply** this encryption scheme to a **single lower-case letter stored in memory**.

Write a function called **encode\_letter**, that takes a memory location as its argument, **loads and encodes** the letter, and finally **stores** the encoded letter back in the same memory location.

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You can assume that the character's memory location is passed to your function in **r0**.

You can use the ASCII encoding scheme below to assist you.

**Assignment Project Exam Help****ASCII TABLE**

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	\$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[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	[NEGATIVE 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	[ENG OF 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	[SUBSTITUTE]	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	[DEL]

Answer on the next page.

Write your answer for Part 3 here:

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**Part 4 5 marks****程序代写代做 CS编程辅导**

Now use your `encode_letter` function to encode a string of characters in memory. You can assume that the string is stored at the label `string_location` in the `.data` section and that it is zero-terminated.



Add from st	0x01	0x02	0x03	0x04	0x05
	0x65	0x6c	0x6c	0x6f	0x00
	e	l	l	o	(End of String)

Make sure your answer accounts for strings of different lengths.

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**Part 5 10 marks****程序代写代做 CS编程辅导**

Explain using diagrams and text what happens to a discoboard program before, during, and after handling an interrupt.

Make sure to indicate the program's execution process as it transitions from normal execution to interrupt, and then back again.



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## Question 4 Networks, OS, & Architecture (25 marks total)

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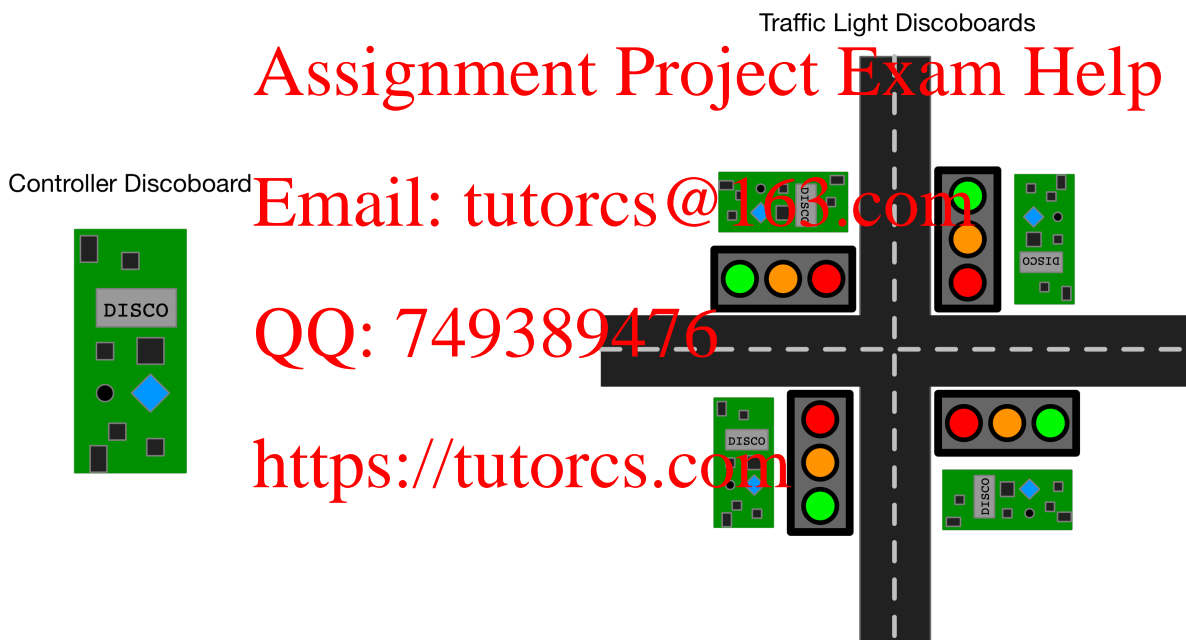
### Part 1 5 marks

You have been asked to design a traffic light controller for a 4-way intersection using discoboard. You're responsible for determining the **physical connections** between the discoboard, and **software** to run the controller.

Each of the four traffic light discoboard and can display three signal lights (red, yellow, and green).

A fifth discoboard (the control board) will be used as a remote controller for the four traffic light discoboard.

The traffic light setup might look something like this:



Your first task is to describe a protocol for the **control discoboard** to control the lights on **just one traffic light board**. Your protocol must be able to turn each signal colour on and off. Discuss the physical connections needed and whether your protocol is serial or parallel.

Be as specific as you can. You may include pictures/diagrams in your answer.

Answer on the next page.



Write your answer for Part 1 here.

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**Part 2 5 marks****程序代写代做 CS编程辅导**

Now you need to extend your network and protocol to allow you to control all **four traffic light discobboards** at the four-way intersection illustrated. Describe how the discobboards will be connected and how the network allows you to control the signals of each traffic light discobboard independently.

Describe the topology and discuss how the traffic light discobboards are addressed independently.

Be as specific as you can. Include pictures/diagrams in your answer.

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**Part 3 10 marks****程序代写代做 CS编程辅导**

Explain the main roles of the operating system in a computer system. Be as specific as you can. You may include pictures/diagrams in your answer.



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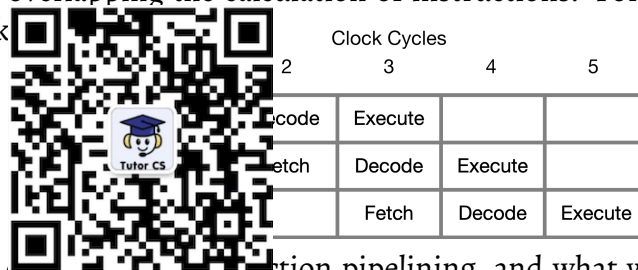
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**Part 4 5 marks****程序代写代做 CS编程辅导**

Computer processors, including the discoboard's ARM Cortex-M4, use pipelining to accelerate execution by overlapping the calculation of instructions. For example, a three-stage pipeline might look



What hazards can occur during instruction pipelining, and what workarounds can be applied to mitigate these? Be as specific as you can. You may include pictures/diagrams in your answer.

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**Note:** you don't have to use all of the following pages for your answer—the extra pages are included in case you need them for other questions (as described on the title page).



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