AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

Computer and Systems Engineering Department
Specialized Programs
Junior Electrical Engineering, Electronics and Communications Engineering
Junior Electrical Engineering, Computer and Systems Engineering

Midterm - Spring 2021 **Course Code: *CSE 211*** ***Time allowed: 1.5 Hr.***

Introduction to Embedded Systems

The Exam Consists of **5** Questions in **2** Pages. ***Maximum Marks: 30 Marks*** **1 / 2**

تعليمات هامة

حيازة التيلفون المحمول مفتوحا داخل لجنة الأمتحان يعتبر حالة غش تستوجب العقاب وإذا كان ضرورى الدخول بالمحمول فيوضع مغلق فى الحقائب.

لا يسمح بدخول سماعة الأذن أو البلوتوث.

لايسمح بدخول أي كتب أو ملازم أو أوراق داخل اللجنة والمخالفة تعتبر حالة غش.

Q1) What is contents of R5 after execution of following instruction, assume R2 contains 0X34560701 and R3 contains 0X56745670.

a. ADD R5, R2, R3
   R5=0x8ACA5D71
b. AND R5, R3, R2
   R5= 0x14540600
c. XOR R5, R2,R3
   R5=0x66225171
d. ADD R5, R3, #0x45
   R5=0X567456B5

Q2) Assume the stack pointer (SP) is initialized to 0x2000.0408. Registers R0, R1, R2 and R12 are initialized to 12, 3, 8 and 5 respectively. Answer the following:

Part a) Show the content of the stack and the SP after the following sequence of operations:

PUSH {R0}
PUSH {R1-R2}
PUSH {R12}

SP-> 0x200003F8	5
0x200003FC	3
0x20000400	8
0x20000404	12
0x20000408	

Part b) Given the state of the stack after part a), show the content of the stack, the SP and registers R3,

R4 after the following operation:

POP {R3-R4}

	0x200003F8	5
	0x200003FC	3
SP->	0x20000400	8
	0x20000404	12
	0x20000408	

R3: 5 R4: 3

Part c) Given the state of the stack after part b), show the content of the stack, the SP and registers R0-R3 after the following operation:
PUSH {R0-R1}
POP {R0-R3}

	0x200003F4	
	0x200003F8	12
	0x200003FC	3
	0x20000400	8
	0x20000404	12
SP->	0x20000408	

R0: 12 R1: 3 R2: 8 R3: 12

Q3) For the below ARM assembly code, trace the values that will be placed into the registers R4, R5, and R6. By tracing, you are expected to write the values of the mentioned registers after the execution of each instruction.

```
        MOV R4, #7
        MOV R5, #4
        MOV R6, #4
again   MOV R7, R4
        ADD R4, R5, R4
        MOV R5, R7
        SUBS R6, R6, #1
        BNE again
```

Answer:

R4 7, 11, 18, 29, 47

R5 4, 7, 11, 18, 29

R6 4, 3, 2, 1, 0

Q4) Write a complete ARM assembly program for the procedure func2. The procedure func2 calculates this C expression ((X+Y)>>3) – Z and stores its value in R0. Assume X, Y, Z are 32-bit signed numbers. X, Y, Z are defined in the memory as shown

```
AREA READ_variables, DATA, READONLY

X       DCD 20

Y       DCD -60

Z       DCD -20
```

Answer:

```
func2
  LDR R0, =X
  LDR R1, =Y
  LDR R2, [R0]
  LDR R3, [R1]
  ADD R0, R2, R3
  ASR R0, R0, #3
  LDR R4, =Z
  LDR R5, [R4]
  SUB R0, R0, R5
  BX LR
```

Q5) For each of the following multiple choice questions, select ONLY the ONE correct answer. Mark your choice in the answer sheet.

1. What is the purpose of register R13 in the ARM Cortex-M processors?

A) R13 is used to store the return address	B) R13 is used to point the next instruction to be fetched
C) R13 is a stack pointer	D) None of the previous

2. Which bus(s) is(are) connected to the Data RAM?

A) ICode bus	B) DCode bus	C) System bus	D) Answers (A) and (B)

3. What is the purpose of the Z flag in the PSR of Cortex-M processors?

A) The Z flag is set after performing an N arithmetic operation	B)The Z flag is set if the result of the operation is less than zero
C) The Z flag is set if result of the operation is zero	D) None of the previous

PROG2: Q4-Q6	
1	#include <stdio.h>
2	int main(){
3	int y=16;
4	int i=7;
5	while (y> 15){
6	printf("%d-",i);
7	y&=~(1<< --i);
8	}
9	return 0;
10	}

4. In PROG2, what is the printed output?

A) 7-6-5-	B) 7-6-5-4-3-	C) 1-2-3-4-5-6-7-	D) 7-6-5-4-

5. In PROG2, what is the final value of *y*?

A) 10	B)7	C) 0	D) 8

6. In PROG2, what is the final value of *y*, if line 5 is changed to be "while (y==15)"?

A) 7	B) 15	C) 16	D) 8

END of Exam

Examination Committee ***Exam Date: 14th of May, 2021***

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