

(SOLUTIONS)

**Class Examination in
EG2068 ELECTRONICS AND MICROPROCESSORS**

Friday 3rd December 1999 4 pm - 5 pm

*Candidates should attempt ALL questions
The paper has a total of 20 Marks.*

1. a) In approximately which year did the first electronic computers appear? [1 mark]
1920-1930; 1930-1940; 1940-1950; 1950-1960; 1960-1970
1940-1950

b) What is the name of the CPU register which stores the address of the next instruction?
PROGRAM COUNTER (PC) [1 mark]

c) Which part of the CPU is responsible for fetching and decoding instructions?
DISPATCH UNIT [1 mark]

2. a) Describe the operation of taking the one's complement of a 16 bit number, by finding the value of ~4 when stored as a 2 byte word. Write your answer in **hexadecimal**.

Description:

IN BINARY 0000 0000 0000 0100

BITW. NOT 1111 1111 1111 1010 0xFFFFB [2 marks]

b) Provide the 16-bit 2's complement (in **binary**) of the following decimal numbers:

+10 = 0000 0000 0000 1010

(i) +10 ~10 = 1111 1111 1111 0101

-10 = 1111 1111 1111 0110 1111 1111 1111 0110 [2 marks]

+32767 = 0111 1111 1111 1111

(ii) +32767. ~32767 = 1000 0000 0000 0000

-32767 = 1000 0000 0000 0001

1000 0000 0000 0001 [2 marks]

c) What is the result (in hexadecimal) of adding the decimal value 50 to the **Hexadecimal** value 0x051E?

Working: 0x051E

+0x0032

0x0550

Answer: 0x0550 [1 mark]

d) A computer executes the following program:	r0	r1
	0x07	?
101: ADD r0, #0x0F	0x16	?
102: MOV r1, #0xF0	0x16	0xF0
103: OR r1, r0	0x16	0xF6
104: AND r0, r1	0x16	0xF6

(i) Given the Program Counter (PC) has a value of 102, after executing an instruction. Which is the next instruction to be fetched?

Assuming that the PC has already being incremented

_____ 102: OR r1, r0 _____ [1 mark]

(ii) If the initial value of r0 is 0x07, what is the **hexadecimal** value **after** executing all the listed instructions?

101-103: 0x07

104: 0x0E

_____ 0x16 _____ [2 marks]

3. a) Given register r0 has the value 0x01, and the memory location 0 has the value 0x06, what is the **hexadecimal** value in register r1 after executing each of the following instructions:

(i) MOV r1, #0

_____ 0x00 _____ [1 mark]

(ii) XOR r1, r1

_____ 0x00 _____ [1 mark]

(iii) MOV r1, 0

_____ 0x06 _____ [1 mark]

b) Consider the following **binary** number: 1000000000000000

(i) when this is interpreted as an **unsigned** 2 byte word (answer in **decimal**)

0x80 00 = 32768

_____ +32768 _____ [1 mark]

(ii) when this contains a 1's complement binary number (answer in **hexadecimal**)

N.B. Number is negative ~number = 0x0111 1111 1111 1111

_____ - 0x7F FF _____ [1 mark]

(iii) when this contains a 2's complement binary number (answer in **decimal**)

Two's comp = One's comp+1 = - 0x80 00 = - 2exp15

_____ - 32768 _____ [1 mark]

c) The following small program consists of two instructions. What is the **hexadecimal** value in register r0 after executing **each** of the two instructions:

a: 0x50 ; first value

b: 0x20 ; second value

MOV r0,a _____ 0x 50 _____ [1 mark]