SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Information Technology

First Year, First Semester Examination – 2018

HNDIT 1104- Data Representation and Organization

Answer Script

Q1)

I. Compare and contrast analog and digital signal.

- Analog signal is a continuous wave that keeps on changing over a time period.
- A digital signal is a discrete wave that carries information in binary form.

Analog Signal

Digital Signal

(02 marks)

II. Convert following decimal numbers into binary number system.

a. $39=100111_2$
b. $146=10010010_2$
c. $0.25=0.01_2$

(Each answer 02 marks, 02×3=06 marks)

III. Convert following decimal numbers into octal number system.

a. $78=116_8$
b. $275=423_8$
c. $0.0625=0.04_8$

(Each answer 02 marks, 02×3=06 marks)

IV. Convert following decimal numbers into hexadecimal number system.

a. $55=37_{16}$
b. $200=C8_{16}$
c. $0.45=0.7_{16}$ **or** $0.73\ldots._{16}$

(Each answer 02 marks, 02×3=06 marks)

V. Convert following data units into bits. (**Hint**: Answers would be given as multiples of numbers. Fully simplified answers are not required.)

a. 512 bytes=512×8 bits
b. 50KB=50×1024×8 bits
c. 650MB=650×1024×1024×8 bits
d. 2.5GB(Gigabytes)=2.5×1024×1024×1024×8 bits
e. 0.5 TB(Terabytes)=0.5×1024×1024×1024×1024×8 bits

(Each answer 01 mark, 01×5=05 marks)

Q2)

I. Give two examples for non-positional number system.

- Roman number system
- Egyptian number system

(Each answer 01 mark, 01×2=02 marks)

II. Draw the truth tables for following logic gates.

a. AND

AND gate

Input A	Input B	Output
0	0	0
1	0	0
0	1	0
1	1	1

b. OR

OR gate

Input A	Input B	Output
0	0	0
1	0	1
0	1	1
1	1	1

c. XOR

EX-OR gate

Input A	Input B	Output
0	0	0
1	0	1
0	1	1
1	1	0

(Each answer 02 marks, 02×3=06 marks)

III. Write the following numbers as polynomial evaluation.

a. 125.45_{10}
$1\times10^{2}+2\times10^{1}+5\times10^{0}+4\times10^{-1}+5\times10^{-2}$

b. 462.125_{8}
$4\times8^{2}+6\times8^{1}+2\times8^{0}+1\times8^{-1}+2\times8^{-2}+5\times8^{-3}$

c. $AB5.6F_{16}$
$10\times16^{2}+11\times16^{1}+5\times16^{0}+6\times16^{-1}+15\times16^{-2}$

(Each answer 02 marks, 02×3=06 marks)

IV. Convert following binary numbers into octal and hexadecimal numbers.

a. $110111=67_{8}=37_{16}$
b. $1111000110=1706_{8}=3C6_{16}$
c. $101111.0011=57.14_{8}=2F.3_{16}$

(Each answer 02 marks, 02×3=06 marks)

V. Convert following numbers into decimal number system

a. 10111.11_2

$1\times2^4+0\times2^3+1\times2^2+1\times2^1+1\times2^0+1\times2^{-1}+1\times2^{-2}$

16+0+4+2+1+0.5+0.25

23.75

(02 marks)

b. $AB.1C_{16}$

$10\times16^1+11\times16^0+1\times16^{-1}+12\times16^{-2}$

160+11+0.0625+0.0039

171.0664

(03 marks)

Q3)

I. Name two disadvantages in 8-bits sign magnitude representation.

- Two values for zero
- Limited range -127 to +127
- It requires complicated computer hardware

(Any 02 answer 02 marks)

II. Convert following numbers into 8 bits sign magnitude form.

a. 43=00101011
b. -29=10011101
c. -124=11111100

(Each answer 02 marks, 02×3=06 marks)

III. Perform the following binary calculations.

a. 11101+1010=100111
b. 10001-100=1101
c. 1011*11=100001
d. 11001/101=101

(Each answer 02 marks= calculation 01 mark+ answer 01 mark)
(02×4=08 marks)

IV. Perform the following calculations.

a. 75_8+45_8

111101+100101

1100010 **or** 142_8

b. $CD_{16}+BE_{16}$

11001101+10111110

110001011 **or** $18B_{16}$

c. $AB_{16} - 6F_{16}$

10101011-01101111

111100 **or** $3C_{16}$

(Each answer 03 marks= conversion 01 + calculation 01 + answer 01)
(03×3=09 marks)

Q4)

I. Convert following decimal numbers into 8 bits one's complement form.

a. 23

10111

00010111 (1's complement)

b. -89

1011001

01011001

10100110 (1's complement)

(Each answer 02 marks= conversion 01 mark+ one's complement 01 mark)
(02×2=04 marks)

II. Convert following numbers into two's complements form.

a. 63

111111

00111111(2's complement)

b. -110
01101110
10010001+1 (add 1)
10010010(2's complement)

(Each answer 02 marks= conversion 01 mark+ two's complement 01 mark)
(02×2=04 marks)

III. Convert following two's complement binary number into decimal format.

a. 11101100_2
Left most bit is 1 hence negative
00010100(mark first bit from right most then flip the bits)
-20

b. 11110111_2
Left most bit 1 hence negative
00001001(marks first bit from right most then flip the bits)
-9

(Each answer 02 marks= calculation 01 mark+ answer 01 mark)
(02×2=04 marks)

IV. Perform following arithmetic calculation with 8-bits sign magnitude.

a. (-65)+(-33)
-65=11000001(sign magnitude)
-33=10100001(sign magnitude)
11000001+10100001
11100010

b. (-76)+56
-76=11001100(sign magnitude)
56=00111000(sign magnitude)
11001100-00111000
10010100

(Each answer 04 marks= conversion 02 mark+ answer 02 mark)
(04×2=08 marks)

V. Perform following calculation with two's complement.
-39+92
-39=11011001(2's complement)
92=01011100(2's complement)
=11011001+01011100
=00110101(Discard the carry out)

(05 marks= 2's complement 02×2 +answer 01 mark)

Q5)

I. Name two data types used in the computer.
Numeric Data
Numbers (Integer, real)
Non-numeric Data
Letters, Symbols
Alphanumeric data
Image data
Audio data
Video data
(Any 02 answers 02 marks)

II. The following numbers in 4 bits BCD code. Identify the equivalent decimal value.

a. 101010110=156
b. 10000110111=437
c. 10010110011000=2598

(Each answer 02 marks, 02×3=06 marks)

III. Express the word "ATI" using ASCII format.(hint ASCII value of **E** is **69**)

Character	A	T	I
ASCII value	65	84	73
ASCII code	1000001	1010100	1001001

IV. Display 79.625 using IEEE single-precision floating point format.

$79.625=1001111.101\times2^{0}$ (02 marks)

1.001111101×2^{6}(normalized form)

Exponent=6+127=133=10000101

Fraction=001111101

Sign bit=0

0	10000101	00111110100000000000000

(Each step 01 mark 01×6=06 marks)

V. Convert following IEEE single precision format into decimal value.

1	01111100	11000000000000000000000000

Sign bit=1

Exponent=$01111100=124_{10}$

Fraction=$0.11000=0.75_{10}$

Apply IEEE formula= $(-) \times (1+0.75) \times 2^{(124-127)}$

-1.75×2^{-3}

-0.21875_{10}

(Each step 01 mark 01×5=05 marks)