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1. Decode the following ASCII code:

[2 marks]

1010011 1110100 1100101 1110110 1100101 0100000 1001010 1101111

1100010 1110011

Answer

1010011- 83- S

1110100- 116- t

1100101- 101- e

1110110- 118- v

1100101- 101- e

0100000- 32 -space

1001010- 74- J

1101111- 111- o

1100010- 98- b

1110011- 115- s

Steve Jobs

2. The state of a 12-bit register is 100010010111. What is its content if it represents

(a) Three decimal digits in BCD?

[1 mark]

(b) Three decimal digits in the excess-3 code?

[1 mark]

(c) Three decimal digits in the 84-2-1 code?

[1 mark]

(d) A binary number?

[1 mark]

Answer

1. Divide the binary into 4-bits beginning from the right = 897

0111 – 2^0+2^1+2^2 = 7

1001 – 2^0+2^3 = 9

1000 – 2^3 = 8

1. Decimal digits in the excess-3 code

8+3 = 11

9+3 = 12

7+3 = 10

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Decimal digits | 8 | 4 | -2 | -1 |
| 8 | 1 | 0 | 0 | 0 |
| 9 | 1 | 1 | 1 | 1 |
| 7 | 1 | 0 | 0 | 1 |

1. Binary number = 100010010111

3. Add and multiply the following numbers without converting them to decimal.

(a) Binary numbers 1011 and 101.

[2 marks]

(b) Hexadecimal numbers 2E and 34

[2 marks]

Answer

1. 1011+101 = 10000
   1. 1011\*101 = 1011+00000+1011100 = 110111

b)2E\*34 = 1B8+8A0 = 958

b.2E + 34 = 62

4. Convert the hexadecimal number 64CD to binary, and then convert it from binary to

octal.

[2 marks]

Answer

64CD = 110010011001101

6 – 2^2+2^1 = 0110

4 – 2^2 =0100

C – 12 – 2^3+2^2 = 1100

D – 13 – 2^3+2^2+2^0 = 1101

Binary to Octal

110 – 6

010 – 2

011 – 3

001 – 1

101 – 5

110010011001101 = 62315 base 8

5. What is the exact number of bytes in a system that contains

(a) 32K bytes

[1 mark]

(b) 64M bytes

[1 mark]

(c) 6.4G bytes

[1 mark]

Answer

a. For 32k bytes:

1 kilobyte (KB) = 1024 bytes

So, 32 kilobytes = 32 \* 1024 bytes = 32,768 bytes

b. For 64m bytes:

1 megabyte (MB) = 1024 kilobytes (KB)

So, 64 megabytes = 64 \* 1024 \* 1024 bytes = 67,108,864 bytes

c. For 6.4g bytes:

1 gigabyte (GB) = 1024 megabytes (MB)

So, 6.4 gigabytes = 6.4 \* 1024 \* 1024 \* 1024 bytes = 6,871,948,800 bytes

6. Determine the base of the numbers in each case for the following operations to be

correct:

(a) 14/2 = 5

[0.5 mark]

(b) 54/4 = 13

[0.5 mark]

(c) 24 + 17 = 40

[0.5 mark]

Answer

a) 14/2=5

Solution: 14\_{x}/2\_{x}=5\_{x} [(1 x x1) + (4 xxº)]/(2xx) = (5 xxº) X (x+4)/2=5 x+4=5\times2 x=10-4 x=6

14/2=5, is correct in base 6.

(b) 54/4=13

Solution: 54\_{x}/4\_{x}=13\_{x} [(5 xx1) + (4 xxº)]/(4xxº) = (1xx1) + (3xx°) (5x+4)/4=(x+3) (5x+4) =4x+12 5x-4x=12-4 x=8

(c) 24+17=40

Solution: 24x/17x=40x [(2\times x) +(4\times x^ {0}) + [(1\times x) +(7\times x^ {0})] = [(4\times x) +(0\times x^{d})] (2x+4) +(x+7) =4x 3x+11=4x 11=4x-3x x=11

7. Convert the following numbers to base 10:

(a) 11002 = ?10

[1 mark]

(b) 1111 1111 11112 = ?10

[1 mark]

(c) 778 = ?10

[1 mark]

(d) 2218 = ?10

[1 mark]

(e) 5BC16 = ?10

[1 mark]

Answer

1. 1100 2^3 + 2^2 = 8+4 = 12
2. 1111 1111 1111 = FFF

= (15\*16^2) + (15\*16^1) + (15\*16^0)

=3840+240+15

=4095 base 10

1. 77 base 8 = (7\*8^1) + (7\*8^0)

= 56 + 7

=63 base 10

1. 221 base 8 = (2\*8^2) + (2\*8^1) + (1\*8^0)

=128+16+1

=145 base 10

1. 5BC base 16 = (5\*16^2) + (11\*16^1) + (12\*16^0)

=1280+176+12

=1468 base 10

8. Convert the following base 10 numbers to the base indicated:

(a) 5610 = ?2

(b) 5610 = ?8

[1 mark]

(c) 5610 = ?16

[1 mark]

(d) 22110 = ?2

[1 mark]

(e) 22110 = ?8

[1 mark]

(f) 22110 = ?16

[1 mark]

Answer

1. 56/2 = 28 remainder 0

28/2 = 14 remainder 0

14/2 = 7 remainder 0

7/2 = 3 remainder 1

3/2 = 1 remainder 1

1/2 = 0 remainder1

56 base 10 = 111000 base 2

1. 56/8 = 7 remainder 0

7/8 = 0 remainder 7

56 base = 70 base 8

1. 56/16 = 3 remainder 8

3/16 = 0 remainder 3

56 base 10 = 38 base 16

1. 221/2 = 110 remainder 1

110/2 = 55 remainder 0

55/2 = 27 remainder 1

27/2 = 13 remainder 1

13/2 = 6 remainder 1

6/2 = 3 remainder 0

3/2 = 1 remainder 1

½ = 0 remainder1

221 base 10 = 11011101 base 2

1. 221/8 = 27 remainder 5

27/8 = 3 remainder 3

3/8 = 0 remainder 3

221 base 10 = 335 base 8

1. 221/16 = 13 – D remainder 13

13/16 = 0 remainder 13 – D

221 base 10 = DD base 16

9. Convert the following numbers from base 10 to base 16

(a) (2020)10

[1 mark]

(b) (2020.65625)10

[1 mark]

(c) (172)10

[1 mark]

(d) (172.983)10

[1 mark]

Answer

1. 2020 ÷ 16 = 126 remainder 4 (4 in hex)

126 ÷ 16 = 7 remainder 14 (E in hex)

7 ÷ 16 = 0 remainder 7 (7 in hex)

(2020)₁₀ = (7E4)₁₆.

Integer part

b) 2020 ÷ 16 = 126 remainder 4 (4 in hex)

126 ÷ 16 = 7 remainder 14 (E in hex)

7 ÷ 16 = 0 remainder 7 (7 in hex)

Fractional part:

0.65625 × 16 = 10.5 (A in hex)

0.5 × 16 = 8.0 (8 in hex)

(2020.65625)₁₀ = (7E4.A8)₁₆.

c) Fractional part: 0.983 × 16 = 15.728 (F in hex)

0.728 × 16 = 11.648 (B in hex)

0.648 × 16 = 10.368 (A in hex)

(172.983)₁₀ = (AC.BFA)₁₆.

11. Convert 43.2 base 8 to binary, base 3, decimal and hexadecimal. Any fractions that

do not terminate should be truncated to 4 digits in the fractional part. [1.5 marks]

Answer

convert 43.2 base 8 to decimal

43.28​=4×8^1+3×8^0+2×8^-1=32+3+82​=35.2510​

Binary:

3510​=100011 base 2  
0.2510​=0.01 base 2

13. Each of the following base 10 numbers in signed

magnitude, one’s complement and two’s complement. Each of

the numbers should be represented in 8 bits.[7.5 marks]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Base | 10 | Signed Magnitude    Binary Representation | One’s Complement    Binary Representation | Two’s Complement    Binary Representation |
|  | 43 | 001010111 | 001010111 | 001010111 |
|  | -43 | 10101011 | 11010100 | 11010101 |
|  | -128 | Invalid | Invalid | Invalid |
|  | 127 | 01111111 | 10000000 | 10000001 |
|  | -1 | 100000001 | 11111110 | 11111111 |