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CSE-1310-002

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**Problem 4**

**Convert the following binary numbers to decimal, hexadecimal and quaternary.**

1. 10001002

Solution:

1. Binary to Decimal:

1 0 0 0 1 0 0

(1\*26)+(0\*25)+(0\*24)+(0\*23)+(1\*22)+(0\*21)+(0\*20) = 6810

64 + 0 + 0 + 0 + 4 + 0 + 0

Answer: 10001002 = 6810

1. Binary to Hexadecimal:

From (1): 10001002 = 6810

Converting 6810 into Hexa-decimal:

68/16 = 4 No remainder: 4

4/16 = 0 Remainder: 4

i.e. 6810 = 4416

Answer: 10001002 = 4416

1. Binary to Quaternary:

From (1): 10001002 = 6810

Converting 6810 into Quaternary:

68/4 = 17 No remainder: 0

17/4 = 4 Remainder: 1

4/4 = 1 No Remainder: 0

1/4 = 0 Remainder: 1

i.e. 6810 = 10104

Answer: 10001002 = 10104

1. 101111112

Solution:

1. Binary to Decimal:

1 0 1 1 1 1 1 1

(1\*27)+(0\*26)+(1\*25)+(1\*24)+(1\*23)+(1\*22)+(1\*21)+(1\*20) = 19110

128 + 0 + 32 + 16 + 8 + 4 + 2 + 1

Answer: 101111112 = 19110

1. Binary to Hexadecimal:

From (1): 101111112 = 19110

Converting 19110 into Hexa-decimal:

191/16 = 11 Remainder: 15 – F

11/16 = 0 Remainder: 11 – B

i.e. 19110 = BF16

Answer: 101111112 = BF16

1. Binary into Quaternary:

From (1): 101111112 = 19110

Converting 19110 into Quaternary:

191/4 = 47 Remainder: 3

47/4 = 11 Remainder: 3

11/4 = 2 Remainder: 3

2/4 = 0 Remainder: 2

i.e. 19110 = 23334

Answer: 101111112 = 23334

1. 10000012

Solution:

1. Binary to Decimal:

1 0 0 0 0 0 1

(1\*26)+(0\*25)+(0\*24)+(0\*23)+(0\*22)+(0\*21)+(1\*20) = 6510

64 + 0 + 0 + 0 + 0 + 0 + 1

Answer: 10000012 = 6510

1. Binary to Hexadecimal:

From (1): 10000012 = 6510

Converting 6510 into Hexa-decimal:

65/16 = 4 Remainder: 1

1/16 = 0 Remainder: 1

i.e. 6510 = 1116

Answer: 10000012 = 1116

1. Binary to Quaternary:

From(1): 10000012 = 6510

Converting 6510 into Quaternary:

65/4 = 16 Remainder:1

16/4 = 4 No remainder: 0

4/4 =1 No remainder: 0

1/4 = 0 Remainder: 1

Answer: 10000012 = 10014

1. 10010112

Solution:

1. Binary to Decimal:

1 0 0 1 0 1 1

(1\*26)+(0\*25)+(0\*24)+(1\*23)+(0\*22)+(1\*21)+(1\*20) = 7510

64 + 0 + 0 + 8 + 0 + 2 + 1

Answer: 10010112 = 7510

1. Binary to Hexa-decimal:

From(1): 10010112 = 7510

Converting 7510 into Hexa-decimal:

75/16 = 4 Remainder: 11 – B

4/16 = 0 Remainder: 4

Answer: 10010112 = 4B16

1. Binary to Quaternary:

From(1): 10010112 = 7510

Converting 7510 into Quaternary:

75/4 = 18 Remainder: 3

18/4 = 4 Remainder: 2

4/4 = 1 No Remainder: 0

1/4 = 0 Remainder: 1

Answer: 10010112 = 10234

**Convert the following hexadecimal numbers to decimal, binary and octal.**

1. 1348F16

Solution:

F = 15

1. Hexadecimal to Decimal:

1 3 4 8 15

(1\*164)+(3\*163)+(4\*162)+(8\*161)+(15\*160) = 7899110

65536 +12288 + 1024 + 128 + 15

Answer: 1348F16 = 7899110

2. Hexadecimal to Binary:

Converting 7899110 into Binary:

78991/2 = 39495 Remainder:1

39495/2 = 19747 Remainder: 1

19747/2 = 9873 Remainder: 1

9873/2 = 4936 Remainder: 1

4936/2 = 2468 No Remainder: 0

2468/2 = 1234 No Remainder: 0

1234/2 = 617 No Remainder: 0

617/2 = 308 Remainder: 1

308/2 = 154 No Remainder: 0

154/2 = 77 No Remainder: 0

77/2 = 38 Remainder: 1

38/2 = 19 No Remainder: 0

19/2 = 9 Remainder: 1

9/2 = 4 Remainder: 1

4/2 = 2 No Remainder: 0

2/2 = 1 No Remainder: 0

1/2 = 0 Remainder: 1

Answer: 1348F16 = 100110100100011112

3. Hexadecimal to Octal:

From (1): 1348F16 = 7899110

Converting 7899110 into octal:

78991/8 = 9873 Remainder: 7

9873/8 = 1234 Remainder: 1

1234/8 = 154 Remainder: 2

154/8 = 19 Remainder: 2

19/8 = 2 Remainder: 3

2/8 = 0 Remainder: 2

Answer: 1348F16 = 2322178

1. AB71116

Solution:

A = 10

B = 11

1. Hexadecimal to Decimal:

10 11 7 1 1

(10\*164)+(11\*163)+(7\*162)+(1\*161)+(1\*160) = 70222510

655360 + 45056 + 1792 + 16 + 1

Answer: AB71116 = 70222510

2. Hexadecimal to Binary:

From (1): AB71116 = 70222510

Converting 70222510 to Binary:

702225/2 = 351112 Remainder:1

351112/2 = 175556 No Remainder: 0

175556/2 = 87778 No Remainder: 0

87778/2 = 43889 No Remainder: 0

43889/2 = 21944 Remainder: 1

21944/2 = 10972 No Remainder: 0

10972/2 = 5486 No Remainder: 0

5486/2 = 2743 No Remainder: 0

2743/2 = 1371 Remainder: 1

1371/2 = 685 Remainder: 1

685/2 = 342 Remainder: 1

342/2 = 171 No Remainder: 0

171/2 = 85 Remainder: 1

85/2 = 42 Remainder: 1

42/2 = 21 No Remainder: 0

21/2 = 10 Remainder: 1

10/2 = 5 No Remainder: 0

5/2 = 2 Remainder: 1

2/2 =1 No Remainder: 0

1/2 = 0 Remainder: 1

Answer: AB71116 = 101010110111000100012

3. Hexadecimal to Octal:

From (1): AB71116 = 70222510

Converting 70222510 into octal:

702225/8 = 87778 Remainder: 1

87778/8 = 10972 Remainder: 2

10972/8 = 1371 Remainder: 4

1371/8 = 171 Remainder: 3

171/8 = 21 Remainder: 3

21/8 = 2 Remainder: 5

2/8 = 0 Remainder: 2

Answer: AB71116 = 25334218

1. 457D16

Solution:

D = 13

1. Hexadecimal to Decimal:

4 5 7 13

(4\*163)+(5\*162)+(7\*161)+(13\*160) = 1778910

16384 + 1280 + 112 + 13

Answer: 457D16 = 1778910

2. Hexadecimal to Binary:

From(1): 457D16 = 1778910

Converting 1778910 into Binary:

17789/2 = 8894 Remainder: 1

8894/2 = 4447 No Remainder: 0

4447/2 = 2223 Remainder: 1

2223/2 = 1111 Remainder: 1

1111/2 = 555 Remainder: 1

555/2 = 277 Remainder: 1

277/2 = 138 Remainder: 1

138/2 = 69 No Remainder: 0

69/2 = 34 Remainder: 1

34/2 = 17 No Remainder: 0

17/2 = 8 Remainder: 1

8/2 = 4 No Remainder: 0

4/2 = 2 No Remainder: 0

2/2 = 1 No Remainder: 0

1/2 = 0 Remainder: 1

Answer: 457D16 = 1000101011111012

3. Hexadecimal to Octal:

From (1): 457D16 = 1778910

Converting 1778910 into octal:

17789/8 = 2223 Remainder: 5

2223/8 = 277 Remainder: 7

277/8 = 34 Remainder: 5

34/8 = 4 Remainder: 2

4/8 = 0 Remainder: 4

Answer: AB71116 = 425758

1. 8777916

Solution:

1. Hexadecimal to Decimal:

8 7 7 7 9

(8\*164)+(7\*163)+(7\*162)+(7\*161)+(9\*160) = 55487310

524288 + 28672 + 1792 + 112 + 9

Answer: 8777916 = 55487310

2. Hexadecimal to Binary:

From (1): 8777916 = 55487310

Converting 55487310 into binary:

554873/2 = 277436 Remainder: 1

277436/2 = 138718 No Remainder: 0

138718/2 = 69359 No Remainder: 0

69359/2 = 34679 Remainder: 1

34679/2 = 17339 Remainder: 1

17339/2 = 8669 Remainder: 1

8669/2 = 4334 Remainder: 1

4334/2 = 2167 No Remainder: 0

2167/2 = 1083 Remainder: 1

1083/2 = 541 Remainder: 1

541/2 = 270 Remainder: 1

270/2 = 135 No Remainder: 0

135/2 = 67 Remainder: 1

67/2 = 33 Remainder: 1

33/2 = 16 Remainder: 1

16/2 =8 No Remainder: 0

8/2 = 4 No Remainder: 0

4/2 = 2 No Remainder: 0

2/2 =1 No Remainder: 0

1/2 =0 Remainder: 1

Answer: 8777916 = 100001110111011110012

3. Hexadecimal to Octal:

From (1): 8777916 = 55487310

Converting 55487310 into octal:

554873/8 = 69359 Remainder: 1

69359/8 = 8669 Remainder: 7

8669/8 = 1083 Remainder: 5

1083/8 = 135 Remainder: 3

135/8 = 16 Remainder: 7

16/8 = 2 Remainder: 0

2/8 = 0 Remainder: 2

Answer: 8777916 = 20735718

**Convert the following decimal numbers to binary, hexadecimal and senary.**

a) 7810

Solution:

1. Decimal to Binary:

78/2 = 39 No Remainder: 0

39/2 = 19 Remainder: 1

19/2 = 9 Remainder: 1

9/2 = 4 Remainder: 1

4/2 = 2 No Remainder: 0

2/2 = 1 No Remainder: 0

1/2 = 0 Remainder: 1

Answer: 7810 = 10011102

2. Decimal to Hexa-decimal:

78/16 = 4 Remainder: 14 – E

4/16 = 0 Remainder: 4

Answer: 7810 = 4E16

3. Decimal to Senary:

78/6 = 13 No Remainder: 0

13/6 = 2 Remainder: 1

2/6 = 0 Remainder: 2

Answer: 7810 = 2106

b) 98010

Solution:

1. Decimal to Binary:

980/2 = 490 No Remainder: 0

490/2 = 245 No Remainder: 0

245/2 = 122 Remainder: 1

122/2 = 61 No Remainder: 0

61/2 = 30 Remainder: 1

30/2 = 15 No Remainder: 0

15/2 = 7 Remainder: 1

7/2 = 3 Remainder: 1

3/2 = 1 Remainder: 1

1/2 = 0 Remainder: 1

Answer: 98010 = 11110101002

2. Decimal to Hexa-decimal:

980/16 = 61 Remainder: 4

61/16 = 3 Remainder: 13 – D

3/16 = 0 Remainder: 3

Answer: 98010 = 3D416

3. Decimal to Senary:

980/6 = 163 Remainder: 2

163/6 = 27 Remainder: 1

27/6 = 4 Remainder: 3

4/6 = 0 Remainder: 4

Answer: 98010 = 43126

c) 100310

Solution:

1. Decimal to Binary:

1003/2 = 501 Remainder: 1

501/2 = 250 Remainder: 1

250/2 = 125 No Remainder: 0

125/2 = 62 Remainder: 1

62/2 = 31 No Remainder: 0

31/2 = 15 Remainder: 1

15/2 = 7 Remainder: 1

7/2 = 3 Remainder: 1

3/2 = 1 Remainder: 1

1/2 = 0 Remainder: 1

Answer: 100310 = 11111010112

2. Decimal to Hexa-decimal

1003/16 = 62 Remainder: 11 – B

62/16 = 3 Remainder: 14 – E

3/16 = 0 Remainder: 3

Answer: 100310 = 3EB16

3. Decimal to Senary:

1003/6 = 167 Remainder: 1

167/ 6 = 27 Remainder: 5

27/6 = 4 Remainder: 3

4/6 = 0 Remainder: 4

Answer: 100310 = 43516

**What is the maximum value that can be held in the following situations?**

a) \_ \_ \_ (Hexadecimal, duodecimal, tridecimal)

1. Hexadecimal

Number of spots = 3

Total number of unique digits in hexadecimal = 16

Maximum value of numbers that can be represented = 163 = 4096

Maximum value that can be held = FFF = 15\*162 + 15\*161 + 15\*160 = 4095

2. Duodecimal

Number of spots = 3

Total number of unique digits in duodecimal = 12

Maximum value of numbers that can be represented = 123 = 1728

Maximum value that can be held = 11\*122 + 11\*121 + 11\*120 = 1727

3. Tridecimal

Number of spots = 3

Total number of unique digits in tridecimal = 13

Maximum value of numbers that can be represented = 133 = 2197

Maximum value that can be held = 12\*132 + 12\*131 + 12\*130 = 2196

b) \_ \_ \_ \_ \_ (septenary, nonary, vigesimal)

1. Septenary

Number of spots = 5

Total number of unique digits in septenary = 7

Maximum value of numbers that can be represented = 75 = 16807

Maximum value that can be held = 6\*74 + 6\*73 + 6\*72 + 6\*71 + 6\*70= 16806

2.Nonary

Number of spots = 5

Total number of unique digits in nonary = 9

Maximum value of numbers that can be represented = 95 = 59049

Maximum value that can be held = = 8\*94 + 8\*93 + 8\*92 + 8\*91 + 8\*90 = 59048

3.Vigesimal

Number of spots = 5

Total number of unique digits in vigesimal = 20

Maximum value of numbers that can be represented = 205 = 3200000

Maximum value that can be held=19\*204+19\*203+19\*202+19\*201+19\*200 = 3199999

c) A byte, in a world where a bit allowed for four unique digits

1 byte = 8 bits

Total number of unique digits = 4

Maximum value of numbers that can be represented = 48 = 65536

Maximum value a byte can held = 48 - 1 = 65535

d) Two bytes, in a world where a bit allowed for six unique digits

2 byte = 16 bits

Total number of unique digits = 6

Maximum value of numbers that can be represented = 616 = 2821109907456

Maximum value a 2 byte can held = 616 - 1 = 2821109907455