**ub2232e**

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**USMAN BASHARAT**

**Number Representation, Number bases, and Data Representation**

1. Indices

Simplify

* 1. a5.a4
  2. (a2.4)1.82
  3. 4m4.1 x 2.3m8.4
  4. a-2.a4

|  |
| --- |
| 15c4  3c5 |

* 1. (3a3)2

|  |
| --- |
| (3y2)4  9y2 |

* 1. n3 x n-1 x n-2
  2. √(a4)
  3. 3√(27b6)

1. Scientific Notation

Represent the following numbers in scientific notation

* 1. 0.000000000006789
  2. 0.1
  3. 4
  4. 7800000000000000
  5. 30.2000000000
  6. 0.006734
  7. 8000
  8. 0.00000356
  9. 120100000000
  10. 2000.34

1. Engineering Notation

Represent the following numbers in Engineering Notation

* 1. 0.1
  2. 8.67x103
  3. 0.707x102
  4. 1.141x10-7
  5. 0.000000000006789
  6. 4

|  |  |
| --- | --- |
| |  | | --- | | 1  6.78x105 | |



|  |  |
| --- | --- |
| |  | | --- | | 1  50x10-4 | |

* 1. 7800000000000000
  2. 30.2000000000

1. Number Bases
   1. Convert the following unsigned decimal numbers to their hexadecimal equivalent. Then expand the hexadecimal notation to binary. Assume the numbers are held in an 8-bit register.
      * 0
      * 17
      * 32
      * 100
      * 120
      * 255
   2. Again, assuming an 8-bit register, convert the following binary patterns to hexadecimal and then to unsigned decimal:
      * 00000010
      * 01101101
      * 10000000
      * 01010101
      * 11111111
   3. Convert the following hexadecimal numbers to unsigned decimal. Use an 8-bit register.
      * 07
      * 24
      * C3
      * AA
      * 7F
      * FF
      * 00
2. Signed Numbers
   1. The following numbers are represented in 8 bit two's complement format. What are the values of the numbers in signed decimal.
      * 07
      * 24
      * C3
      * AA
      * 7F
      * FF
      * 00
   2. Convert the following signed decimal numbers to their 8-bit binary and hexadecimal 2’s complement representation. If a number cannot be represented in 8 bits, indicate what the problem is, and provide the appropriate 16-bit signed 2’s complement representation:
      * -1
      * +17
      * -81
      * 127
      * -127
      * -200
      * +350
3. Addition and Subtraction

Calculate the following decimal additions and subtractions. Then using 8 bit 2’s complement representation perform the calculations again. Confirm if the results of  the 2’s complement calculations are correct, if not state why.

* 1. 12 - 8 =
  2. 118 + 75 =
  3. 255 + 255 =
  4. 254 -255 =
  5. 68 + 102 =

1. To make them easy to remember, IP4 addresses are usually written in dotted decimal notation - four decimal numbers separated by dots - A Class A address starts with the Most Significant Bit (MSB) as a 0, a Class B address has the first two MSBs as 10 and a Class C address has the first three MSBs as 110.

Convert the following binary IP address and their associated subnet masks to dotted decimal notation.

* 1. 01110101.11010111.00110001.11100101            11111111.00000000.00000000.00000000
  2. 10110101.11001100.00110101.11010101            11111111.11111111.00000000.00000000
  3. 11001011.11001010.00101011.10101011            11111111.11111111.11111111.00000000

Convert the following IP address to binary and identify which class the following IP addresses belong to. Write down the default sub mask for each of the addresses.

122.45.34.20

150.34.46.70

193.60.77.45

1. A programmer examined the store of a byte-addressed memory, and found the following contents. Assuming this is ASCII text, what message is it?

48, 65, 6C, 6C, 6F, 20, 43, 53, 41, 21, 0D, 0A

1. A set of traffic lights is controlled by an 8-bit computer (i.e. the computer sends an 8-bit value to an output device connected to the traffic lights) as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| North-South | | | | East-West | | | |
| Green Filter | Green Main | Amber | Red | Green Filter | Green Main | Amber | Red |
| bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |

1. Write down the sequence of decimal numbers that must be sent to the output port to control the traffic lights.
2. A computer register is required to capable of storing an unsigned binary integer of 64578310. Use logs to calculate the required register size. ([Need help with Logs?](http://staffweb.cms.gre.ac.uk/~sp02/numberbases/logs.html))
3. Discuss why 2's compliment arithmetic is used in preference to signed or 1's compliment arithmetic. Give examples to illustrate your answer.
4. Discuss why computers make a distinction between floating point numbers and integers.
5. An eight-bit register contains 00101101. The register is left shifted by 1 bit and a 0 inserted into the Least Significant Bit (LSB), what function has been performed?
6. An eight-bit register contains 00101101. The register is right shifted by 1 bit and with the ousted LSB stored in a flag, and a 0 inserted into the Most Significant Bit (MSB). What function has been performed?