1. Convert $188_{10}$ into binary, octal and hexadecimal.

2. Convert $ABC_{16}$ into binary, octal and decimal.

3. Add the following two 20-bit binary numbers. Spaces embedded in the numbers are for readability only.

   1st number  1111 0000 1111 0000 1111
   2nd number  1010 1010 1011 1111 1111

4. Using the two numbers in question 3, subtract the second binary number above from the first.

5. What is the square of $10101_2$ in base 2?

6. What is $14_5$ in base 1 (Unary) ?

7. How many natural numbers can be represented by
   (i) 8-bits
   (ii) 10-bits
   (iii) 16-bits

8. For an 8-bit group, work out the representation for $-37_{10}$ in
   (i) sign & magnitude
   (ii) one's complement
   (iii) two's complement
   (iv) excess-256
   (v) excess-128

9. For a 10-bit group, what range of integers can be represented using
   (i) sign & magnitude
   (ii) one's complement
   (iii) two's complement
   (iv) excess-512

10. Subtract the following 12-bit two's complement numbers (2nd from 1st)

    $1010 1010 1011$
    $-1011 0000 1101$

    What is the result in decimal?
12. Express $98765_{10}$ in binary coded decimal (BCD)

13. Translate the following 6-character string $A := q*t$ to 8-bit ASCII codes (List your codes as binary and hex values).
Solutions

This page is upside down to discourage you from peeking.
Remember to show your working and to carry out your conversions and calculations without a calculator.

1. \[188_{10} = 1011_2 = 274_8 = BC_{16}\]

2. \[\text{ABC}_{16} = 1010_2 \cdot 1011_2 = 5274_8 = 2748_{10}\]

3. \[\text{Sum} = 1_{10}001_2 \cdot 1011_2 \cdot 0000_2 \cdot 1110_2\]

4. \[\text{Diff} = 0100_2 \cdot 0110_2 \cdot 0011_2 \cdot 0001_2 \cdot 0000_2\]

5. \[\text{Square} = 1_{10}011_2 \cdot 1001_2\]

6. \[1_{1111} \cdot 1_{1111} \cdot 1\]

7. \[(i) \ 2^8 = 256, \ (ii) \ 2^{10} = 1024, \ (iii) \ 2^{16} = 65536\]

8. \[(i) \ 1010_2 \cdot 0101_2, \ (ii) \ 1101_2 \cdot 1010_2, \ (iii) \ 1101_2 \cdot 1011_2, \ (iv) \ 1101_2 \cdot 1111_2, \ (v) \ 0101_2 \cdot 1011_2\]

9. \[(i) \ -511 \text{ to } +511, \ (ii) \ -511 \text{ to } +511, \ (iii) \ -512 \text{ to } +511, \ (iv) \ -512 \text{ to } +511\]

10. \[1111_{10} \cdot 1110 = \text{decimal } -98\]

11. \[1001_2 \cdot 1000_2 \cdot 0111_2 \cdot 0110_2 \cdot 0101_2\]

12.

<table>
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<th>Char</th>
<th>A</th>
<th>:</th>
<th>=</th>
<th>q</th>
<th>*</th>
<th>t</th>
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<tbody>
<tr>
<td><strong>Binary</strong></td>
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<td>0011 1010</td>
<td>0011 1101</td>
<td>0111 0001</td>
<td>0010 1010</td>
<td>0111 0100</td>
</tr>
<tr>
<td><strong>Hex</strong></td>
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<td>1</td>
<td>3</td>
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<td>3</td>
<td>D</td>
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<td>7</td>
<td>1</td>
<td>2</td>
<td>A</td>
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</tbody>
</table>

N. Dulay
Integers and Characters (33)