

## Number Bases - Tutorial Session-1 (and answers)

1. Convert the following binary numbers to equivalent decimal numbers.

- (a)  $(1101)_2$                     **13**
- (b)  $(11101)_2$                     **29**
- (c)  $(0101\ 1101)_2$                 **93**
- (d)  $(1101\ 1101)_2$                 **221**
- (e)  $(1111\ 1111)_2$                 **255**
- (f)  $(0101\ 1001)_2$                 **89**
- (g)  $(1101\ 1101\ 0101)_2$         **3541**
- (h)  $(11100.101)_2$                 **28**

2. Convert the following decimal numbers to equivalent binary numbers.

- (a)  $(57)_{10}$                      **$(111001)_2$**
- (b)  $(45)_{10}$                      **$(101101)_2$**
- (c)  $(255)_{10}$                     **$(11111111)_2$**
- (d)  $(256)_{10}$                     **$(10000000)_2$**
- (e)  $(2416)_{10}$                    **$(100101110000)_2$**
- (f)  $(4195)_{10}$                    **$(1000001100011)_2$**

3. Convert the following octal numbers to equivalent decimal numbers.

- (a)  $(45)_8$                      **$(37)_{10}$**
- (b)  $(2243)_8$                     **$(1187)_{10}$**

4. Convert the following decimal numbers to equivalent octal numbers.

- (a)  $(19)_{10}$                      **$(23)_8$**
- (b)  $(132)_{10}$                     **$(204)_8$**
- (c)  $(512)_{10}$                     **$(1000)_8$**

5. Convert the following hexadecimal numbers to equivalent decimal numbers.

- (a)  $(B4)_{16}$                     **180**
- (b)  $(1FF)_{16}$                    **511**
- (c)  $(28AD)_{16}$                   **10413**

6. Convert the following decimal numbers to equivalent hexadecimal numbers.

- (a)  $(19)_{10}$                      **$(13)_{16}$**
- (b)  $(312)_{10}$                     **$(138)_{16}$**
- (c)  $(513)_{10}$                     **$(201)_{16}$**

7. Convert the following binary numbers to equivalent octal numbers.

- (a)  $(1\ 1101)_2$                     **$(35)_8$**
- (b)  $(1\ 0110\ 1101)_2$              **$(555)_8$**
- (c)  $(1011\ 0101)_2$              **$(265)_8$**

8. Convert the following binary numbers to equivalent hexadecimal numbers.

- (a)  $(10\ 1010)_2$                  **$(2A)_{16}$**
- (b)  $(1\ 1110\ 0110)_2$              **$(1E6)_{16}$**
- (c)  $(1101\ 0101)_2$              **$(D5)_{16}$**

9. Miscellaneous - Perform the following base conversions

- (a)  $(141)_5 = (?)_{10}$   **$(46)_{10}$**
- (b)  $(36)_{10} = (?)_7$   **$(51)_7$**
- (c)  $(110\ 0101)_2 = (?)_4$  (Is there a shortcut way to do this?)  **$(1211)_4$**

10. Perform the following **unsigned binary** arithmetic. Verify your answer by converting each problem into decimal. (Note: the last two are subtraction!)

<p>a. <math display="block">\begin{array}{r} 0111\ 0101 \\ +\ 0011\ 0011 \\ \hline \mathbf{1010\ 1000} \end{array}</math> <p style="text-align: right;"><b><math>(168)_{10}</math></b></p> </p>	<p>b. <math display="block">\begin{array}{r} 0010\ 0110 \\ +\ 0101\ 1011 \\ \hline \mathbf{1000\ 0001} \end{array}</math> <p style="text-align: right;"><b><math>(129)_{10}</math></b></p> </p>
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<p>c. <math display="block">\begin{array}{r} 1001\ 0011 \\ +\ 0011\ 1011 \\ \hline \mathbf{1100\ 1110} \end{array}</math> <p style="text-align: right;"><b><math>(206)_{10}</math></b></p> </p>	<p>d. <math display="block">\begin{array}{r} 0101\ 1100 \\ +\ 0001\ 1111 \\ \hline \mathbf{111\ 1011} \end{array}</math> <p style="text-align: right;"><b><math>(123)_{10}</math></b></p> </p>
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<p>e. <math display="block">\begin{array}{r} 1001\ 1011 \\ -\ 0011\ 1011 \\ \hline \mathbf{110\ 0000} \end{array}</math> <p style="text-align: right;"><b><math>(96)_{10}</math></b></p> </p>	<p>f. <math display="block">\begin{array}{r} 0101\ 1001 \\ -\ 0001\ 1111 \\ \hline \mathbf{11\ 1010} \end{array}</math> <p style="text-align: right;"><b><math>(58)_{10}</math></b></p> </p>
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11. Perform the following **octal** arithmetic. Verify your results by converting each problem into decimal.

<p>a. <math display="block">\begin{array}{r} 424 \\ +\ 163 \\ \hline \mathbf{607} \end{array}</math> <p style="text-align: right;"><b><math>(391)_{10}</math></b></p> </p>	<p>b. <math display="block">\begin{array}{r} 5112 \\ +\ 1346 \\ \hline \mathbf{6460} \end{array}</math> <p style="text-align: right;"><b><math>(3376)_{10}</math></b></p> </p>
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12. Perform the following **hexadecimal** arithmetic. Verify your results by converting each problem into decimal. (Note: the last two are subtraction!)

<p>a. <math display="block">\begin{array}{r} A4 \\ +\ 27 \\ \hline \mathbf{CB} \end{array}</math> <p style="text-align: right;"><b><math>(203)_{10}</math></b></p> </p>	<p>b. <math display="block">\begin{array}{r} 7F3 \\ +\ 41D \\ \hline \mathbf{C10} \end{array}</math> <p style="text-align: right;"><b><math>(3088)_{10}</math></b></p> </p>
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<p>c. <math display="block">\begin{array}{r} 806 \\ -\ 4B \\ \hline \mathbf{7BB} \end{array}</math> <p style="text-align: right;"><b><math>(1979)_{10}</math></b></p> </p>	<p>d. <math display="block">\begin{array}{r} 56C \\ -\ 1FF \\ \hline \mathbf{36D} \end{array}</math> <p style="text-align: right;"><b><math>(877)_{10}</math></b></p> </p>
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