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1. Determine the base of the numbers in each case for the following operations to be correct:

   (a) 14/2=5

   (b) 54/4=13

   (c) 24+17=40

   Sol:

   (a) 14/2=$(b+4)/2 = 5$,so $b = 6$

   (b) $54/4 = (5 * b + 4)/4 = b + 3$, so $5 * b = 524$, and $b = 8$

   (c) $(2 * b + 4) + (b + 7) = 4b$, so $b = 11$

2. Express the following numbers in decimal

   (a) $(10110.0101)_2$

   (b) $(16.5)_{16}$

   Sol:

   (a) $(10110.0101)_2 = 16 + 4 + 2 + .25 + .0625 = 22.3125$

   (b) $(16.5)_{16} = 16 + 6 + 5 * (.0615) = 22.3125$

3. Obtain 1's and 2's complements for the following binary numbers:

   (a) 00010000

   (b) 00000000

   (c) 11011010

   (d) 10101010

   (e) 10000101

   (f) 11111111

   Sol: one's complement

   (a) 11101111

   (b) 11111111

   (c) 00100101

   (d) 01010101

   (e) 01111010

   (f) 00000000

   two's complement

(a) 11110000

(b) 00000000

(c) 00100110

(d) 01010110

(e) 01111011

(f) 00000001

4. Perform subtraction on the given unsigned binary numbers using the 2s complement of the subtrahend. Where the result should be negative, find its 2s complement and affix a minus sign.

   (a) 10011 - 10010

   (b) 100010 - 100110

   (c) 1001 - 110101

   (d) 101000 - 10101

   Sol: First we find the two's complement of the number to subtract. Next we can add them

   (a) The number to be subtracted is 10010. Its two's complement is 01110. Then we perform addition 10011+01110 = 00001.

   (b) The number to be subtracted is 100110. Its two's complement is 011010. Then we perform addition 100010+011010 = 111100. We expect the result to be negative, so we take another two's complement which is 000100. So the answer is -000100.

   (c) The number to be subtracted is 110101. Its two's complement is 001011. Then we perform addition 001001+001011 = 010100. We expect the result to be negative, so we take another two's complement which is 101011+1=101100. So the answer is -101100.

   (d) The number to be subtracted is 010101. Its two's complement is 101011. Then we perform addition 101000+101011 = 010011.

5. The following decimal numbers are shown in signmagnitude form: +9,286 and +801. Convert them to signed-10scomplement form and perform the following operations (note that the sum is +10,627 and requires five digits and a sign).

   (a) (+9,286) + (+801)

   (b) (+9,286) + (-801)

   (c) (-9,286) + (+801)

   (d) (-9,286) + (-801)

   Sol:

   (a) (+9,286) + (+801)= 009286 + 000801 = 010087

   (b) (+9,286) + (-801)= 009286 + 999199 = 008485

   (c) (-9,286) + (+801)= 990714 + 000801 = 991515

   (d) (-9,286) + (-801)= 990714 + 999199 = 989913

6. Decode the following ASCII code:

   1010011 1110100 1100101 1110110 1100101 0100000 1001010 1101111 1100010 1110011. **Sol:** Steve Jobs