CompSci 150 Homework 1

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1. (a) OR:

$$\left[\begin{array}{cc|c} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{array}\right]$$

   (b) AND:

$$\left[\begin{array}{cc|c} 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{array}\right]$$

   (c) XOR:

$$\left[\begin{array}{cc|c} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{array}\right]$$

   (d) NOT:

$$\left[\begin{array}{c|c} 0 & 1 \\ 1 & 0 \end{array}\right]$$

2. (a) $(x \text{ XOR } y) \vee (x \wedge y)$:

$$\left[\begin{array}{cc|c} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{array}\right]$$

(b) NOT$((x \vee y) \wedge z)$:

$$\left[\begin{array}{ccc|c} 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{array}\right]$$

3. (a) RAM: Random Access Memory, stores short-term data which can be referred back to by the computer.

   (b) Sequential Access: Opposite of RAM, instead of reading randomly, data must be read sequentially. Slower than RAM but more space.

   (c) WORM: Write Once, Read Many. Data storage which can be written only once, then read many times, good for things like games, movies.

   (d) WMRM: Write Many, Read Many. Data storage which can be written and read as many times as needed.

   (e) ASCII: American Standard Code for Information Interchange, a character encoding format, each character is given a numerical value which computers can then use.

4. Bitstring to Hex:

   (a) $0101_2 = 5_{16}$

   (b) $0010_2 = 2_{16}$

   (c) $1010_2 = A_{16}$

   (d) $1101_2 = D_{16}$

5. Decimal to Binary:

   (a) $21 = 10101_2$

   (b) $15 = 1111_2$

   (c) $43 = 101011_2$

   (d) $128 = 10000000_2$

(e) $3\frac{5}{8} = 11.101_2$

(f) $9\frac{11}{64} = 1001.001011)_2$

6. Binary to Decimal:

   (a) $11_2 = 3$

   (b) $101_2 = 5$

   (c) $101110_2 = 46$

   (d) $11010001_2 = 209$

   (e) $11.101_2 = 3\frac{5}{8}$

   (f) $10.1011_2 = 2\frac{11}{16}$

7. Decimal to 2‘s complement.

   (a) $17 \to 101111$

   (b) $21 \to 101011$

   (c) $-19 \to 010011$

   (d) $-27 \to 011011$

8. 2‘s complement to Decimal:

   (a) $0010101 \to 21$

   (b) $0011010 \to 26$

   (c) $1010101 \to -43$

   (d) $1110010 \to -14$

9. Binary addition:

   (a)
   $$1101 + 0110 = 10011$$

   (b)
   $$101 + 011 = 1000$$

   (c)
   $$01.01 + 10.11 = 100.00$$

(d)

$$11.0110 + 00.1101 = 100.0011$$

10. 2's complement addition:

$$1010 + 0110 = 10000 \quad \text{(Underflow)}$$

$$0101 + 0011 = 1000 \quad \text{(Overflow)}$$

$$0111 + 1100 = 10011 \quad \text{(Underflow)}$$

$$1011 + 1100 = 10111$$

11. (a) Memory Module: Very fast, but low storage. Can read and write very quickly.

    (b) Hard Drive: Slower to read and write data, much larger storage for similar size.

    (c) CD-ROM: Even slower than HDD, prone to damaging the physical disk, losing data.

12. The faster the platter spins, the faster the computer can locate the data you ask for. (Since it is sequential, it has to first go through all of the data leading up to it.)

13. CD-RW is rewriteable, whereas CD-R is not. CD-RW is WMRM, CD-R is WORM.

14. Higher sample rate means a more accurate representation of the original sound. However it also consumes much more storage.

15. (a) Resolution: The number of pixels in the bitmap, higher resolution means more pixels, which leads to a "crisper" image quality.

    (b) Color: Each pixel in the bitmap has some color, usually in hexadecimal, with a red, green and blue portion which defines its color.

16.

$$000 \rightarrow 0001$$
$$001 \rightarrow 0010$$
$$010 \rightarrow 0100$$
$$011 \rightarrow 0111$$
$$100 \rightarrow 1000$$
$$101 \rightarrow 1011$$
$$110 \rightarrow 1101$$
$$111 \rightarrow 1110$$

17. Data compression is important because video files grow huge very quickly, so being able to compress it into a smaller size greatly reduces the storage needed.