Discrete Mathematics
Problem Set 9
Logic and Computer

1. (a) Convert the binary numeral 111001 to decimal, showing your work.
   (b) Convert the decimal numeral 87 to binary, showing your work.

2. Hexagonal notation is a particular way of writing base-16 numerals, using sixteen hexadecimal digits: 0 through 9 with the same meanings they have in decimal, and A through F to represent decimal 10 through 15. The following table shows the sixteen decimal digits and their corresponding binary and decimal notations.

Hex	Binary	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

It is easy to translate back and forth between hexadecimal and binary, simply by substituting hexadecimal digits for blocks of four bits or vice versa. For example, since 8 in hex is 1000 in binary and A in hex is 1010 in binary, the four-hex-digit numeral 081A in binary is

000 01000 0001 1010

where small spaces between block of four bits are introduced for readability.

(a) Write the binary numeral 1110000110101111 in hexadecimal and in decimal.

(b) Write decimal 1303 in binary and in hexadecimal.

(c) Write hexadecimal ABCD in binary and in decimal.

3. Write formula involving only the $|$ operator that is equivalent to $p \vee q$.

4. Let $p \downarrow q$ denote the "nor" operator. $p \downarrow q$ is true if and only if neither p nor q is true i.e $p \downarrow q \equiv \neg(p \vee q)$.

   (a) Write the truth table for $p \downarrow q$.

   (b) Using only the $\downarrow$ operator, write a formular equivalent to $\neg p$.

   (c) Show that $\vee$ and $\wedge$ can also be expressed using just the $\downarrow$ operator.