Question 1

(a) The first 16 hexadecimal integers ≥ 0 can be represented by 4 bit binary strings as follows:

0000 : 0	0100 : 4	1000 : 8	1100 : C
0001 : 1	0101 : 5	1001 : 9	1101 : D
0010 : 2	0110 : 6	1010 : A	1110 : E
0011 : 3	0111 : 7	1011 : B	1111 : F

(i) Find the hexadecimal equivalent of the binary numeral 1101101.01

(ii) Find the binary equivalent of the hexadecimal numeral $A9.B$

(a) The first 16 integers ≥ 0 can be represented by 4 bit binary strings.

(i) List these integers in hexadecimal, together with their binary equivalents.

(ii) Find the hexadecimal equivalent of the binary numeral 100101.01 and find the binary equivalent of the hexadecimal numeral 59.A [4]

(b) Working in the binary system compute the following sum, showing all your working:

$$(110111)_2 + (1010111)_2 + (1110111)_2.$$

Question 3 (a) Given propositions p and q, construct the truth tables for:

$$p \wedge q; \quad q \to p; \quad \neg p \wedge (p \vee q).$$

[3]

(b) A deck of cards contains six cards numbered $1, 2, 3, 4, 5$ and 6. An experiment is carried out in which three cards are chosen from this deck **without** replacement and the result is recorded as an ordered triple, such as $(1,2,4)$, where this result is different from the result $(2,4,1)$.

    (i) Let A be the event that the first card is even and B the event that the last card is a 6. Calculate the number of elements in each of the sets A, B, $A \cap B$ and $A \cup B$.

    (ii) Hence calculate the probabilities of A, B, $A \cap B$ and $A \cup B$.   [8]

Question 9

(a) In an experiment a coin is tossed three times and each time it is noted whether the coin comes up heads (H) or tails (T). The final result is recorded as an ordered triple, such as (H,H,T). Let A be the event that the last toss comes up as a head and B be the event that there is only one head in the triple.

   i. Draw a rooted tree to model this process.

   ii. Calculate the probabilities of the events A, B, $A \cap B$ and $A \cup B$.

   iii. Are A and B independent events? Justify your answer.

[7]