**CS1005 Logic & Computation  
Lab sheet 7: Propositional Logic**

**Question 1**

Classify each of the following sentences as simple propositions, compound propositions or not propositions:

1. If John takes the umbrella, it’s bound to be raining.
2. Compile the program now!!
3. Shawn is a maths major but not a computer science major.
4. 2 to the power of 6 is equal to 256.
5. Number 5 is even or number 3 is odd.
6. Steven Gerrard scored two goals during 2005 Champions league final.

**Question 2**

Write the following statements in symbolic form using the symbols ~, V, Λ, →, and ↔ where applicable. You can use your own letters to represent the statements.

1. Mary has got an American accent.
2. Paul is 25 years old and does not possess a helicopter flying licence.
3. John can go swimming or use sauna and shower.
4. Share price will go up, and if interest goes up too, then there will be a recession.
5. Either Harry will go out to play football or he will go out to watch a movie but not both.
6. X is 25 and Y is 20, these denote that (X+Y)>=40.
7. If Rita has installed central heating in his house, then she has sold her car or has won a lottery.
8. 24 is even if and only if 24 is divisible by 2.

**Question 3**

Construct truth tables for the following statement forms:

1. **p ∧ ~q**
2. **(p ∧ (~(~p∨ q))) ∨ (p∧q)**
3. **(~p∨q)** **→~q**
4. **(r∨p) ∧ ((~r∨(p∧q)) ∧(r∨q))**
5. **(~p∨q) →(r∨~q)**
6. **(~p↔~q) ↔(p↔q)**
7. **(p→(q→r)) ↔((p∧q) →r)**

**Question 4**

Use truth tables to establish which of the statement forms are tautologies, or contradictions:

1. **(p∧~q) ∧ (~p ∨ q)**
2. **(~p∨q) ∨ (p∧~q)**
3. **((~p∧q) ∧ (q∧r)) ∧ ~q**

**Question 5**

The logician Raymond Smullyan describes an island containing two types of people: knights who always tell the truth and knaves who always lie. You visit the island and are approached by two natives (A and B):

1. A says: We are both knights

B says: A is a knave.

*What are A and B?* Note: You must use truth table

1. A says: B is a knight

B says: The two of us are of different types.

*What are A and B?* Note: You must use truth table

1. A says: We are both knights

B says: Either A is a knight or I am a knight, but we are not both knights

*What are A and B?* Note: You must use truth table