1. Introduce variables and express the following sentences symbolically.

(a) I will go to London or Paris, but not both.
(b) Either Dave, Jing or Maria is lying, or they are all lying.
(c) Peter and Xia are not both over two meters tall.
(d) Peter and Xia are both not over two meters tall.
(e) Olga is rich and famous, or she is not rich.
(f) There is no cake left and I am hungry, or there is cake left but I am not hungry.

2. Write grammatical english sentences with the following structures.

(a) \((P \land Q) \lor \neg P\)
(b) \((A \lor B) \land (\neg A \land B)\)
(c) \(\neg(D \land F) \lor F\)
(d) \(\neg(G \lor H) \land G\)

3. Make truth tables of each of the following.

(a) \(P \land \neg Q\)
(b) \((P \land Q) \lor \neg P\)
(c) \((P \lor Q) \land (\neg P \land Q)\)
(d) \((P \lor Q) \land (P \lor R)\)

4. Create truth tables for each of the following. Are any of them equivalent?

(a) \(A \land \neg B\)
(b) \(\neg(A \lor \neg B)\)
(c) \((A \land B) \lor (\neg A \land B)\)
(d) \(\neg A \lor (A \land \neg B)\)
(e) \((A \lor B) \lor (A \land \neg B)\)

5. Simplify the following expressions.

(a) \((P \lor (\neg P \land P)) \land \neg P\)
(b) \((P \land (Q \land R)) \lor (P \land R)\)
(c) \(\neg(P \land (\neg P \land Q))\)
(d) \(\neg(P \land \neg Q) \lor (P \land Q)\)
(e) \((P \lor Q) \land (P \land \neg Q)\)
(f) \(\neg(\neg P \land Q) \land (\neg P \land Q)\)
(g) \((\neg Q \land (P \lor R)) \lor (P \land Q)\)
6. Write the truth set of each of the following statements. Be as explicit as you can, and give complete justification for your answers (note: you may need to use calculus).

(a) \( n \) is an integer and \( n^2 < 5 \)
(b) \( n \) is a positive integer and \( n \) is divisible by 2 or 5
(c) \( x \) is a real number and \( \sin^2 x = 1 \)
(d) \( x \) is a real number and \( \sin x = 0 \) and \( \sin 2x = 1 \)
(e) \( x \) is a real number and \( x^2 - 6x + 1 = 0 \)
(f) \( x \) is a real number and \( x^4 - x^3 + \frac{27}{256} = 0 \)

7. Evaluate each of the following arguments with truth tables, and conclude whether they are valid or not.

(a) • Andy are Bin are both tall, or neither of them is.
   • Either Andy is tall or Bin is.
   • Bin is tall.
(b) • Alex is friendly, and Bob or Clara is friendly.
   • Bob is friendly, and Alex or Clara is friendly.
   • Therefore, Clara is friendly.