

Exercise No. 01:

Write the following expressions in predicate logic:

- 1) Imad is Zina's father
- 2) Fares is the father of Fatma and Zouhir
- 3) The horse is faster than the dog.
- 4) They are all students
- 5) Every student is registered
- 6) Some students are not sick
- 7) Not all men travel with John
- 8) If all men travel with John, then he is happy
- 9) People who have a fever and cough have the flu.
- 10) People who have the flu should take Tamiflu.

Exercise No. 02:

L is a predicate language defined as follows:

Constant A, B function f, g predicate P, Q, R variable x, y

Which of the following expressions are syntactically correct terms or formulas?

1. $R(A, g(A, A))$
2. $\neg y \wedge P(y)$
3. $g(A, g(A, A))$
4. $\forall x P(x)$
5. $\neg R(P(A), x)$
6. $\exists x \forall y (R(x, y) \Rightarrow R(y, x))$
7. $\exists A R(A, A)$
8. $\forall x Q(x, f(x), B) \Rightarrow \exists x R(A, x)$

Exercise No. 03:

Indicate the free variables in the following formulas:

1. $P(x) \wedge R(y, a)$
2. $\exists y (Q(y) \wedge P(x))$
3. $\forall x \exists y R(x, f(y))$
4. $\forall x (P(x) \Rightarrow Q(x))$
5. $\forall x P(x) \Rightarrow Q(y)$
6. $P(x) \Rightarrow \exists x Q(x)$
7. $\exists x (P(x) \Rightarrow Q(x))$
8. $\forall x (P(x) \Rightarrow \exists y (Q(y) \wedge R(x, y)))$

Exercise No. 04:

Construct the construction tree and perform the negation of the following formulas:

- $\forall x \exists y (P(x) \vee Q(y))$
- $\forall x (P(x) \Rightarrow \exists y (Q(y) \wedge R(x, y)))$
- $\forall x \exists y (R(x, y) \Rightarrow (R(y, x) \vee Q(f(A), g(A, x))))$