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# Homework

## 1.1 Propositional Logic

2) Which of these are propositions? What are the truth values of those that are propositions?

Ans: Propositions must have clearly defined truth values, so a proposition must be a declarative sentence with no free variables.

a) Do not pass go.
⇒ This is not a proposition; it's a command.

b) What time is it?
⇒ This is not a proposition; it's a question.

c) There are no black flies in Maine.
⇒ This is a proposition that is false

d) $4 + x = 5$
⇒ This is not a proposition; it's truth value depends on the value of $x$

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e) The moon is made of green cheese.

⇒ This is a proposition that is false.

f) $2^n \geq 100$

⇒ This is not a propositions, it's truth value depends on the value of n

## Ans No: 13

Let, p and q be propositions

p: It is below freezing.

q: It's snowing

Write these propositions using p and q and logical connectives (including negations).

(a) It is below freezing and snowing.

⇒ $p \wedge q$

(b) It is below freezing but not snowing

⇒ $p \wedge \neg q$

(c) It is not below freezing and it is not snowing.

⇒ $\neg p \wedge \neg q$

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(d) It's either snowing or below freezing (or both)

$\Rightarrow p \vee q$

then

(e) If it is below freezing, it is also snowing.

$\Rightarrow p \rightarrow q$

f) Either it is below freezing or it is snowing, but it is not snowing if it is belog freezing.

$\Rightarrow (p \vee q) \wedge (p \rightarrow \neg q)$

g) That it is below freezing necessary and sufficient for it to be snowing.

$\Rightarrow p \leftrightarrow q$

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## Ans No: 19

Determine whether each of these conditional statments is true or false.

a) If $1+1=2$, then $2+2=5$

⇒ Since the hypothesis is 'true' and the conclusion is 'false', this conditional statments is **false.**

b) If $1+1=3$, then $2+2=4$

⇒ " " " " 'false' and " "

" 'true' then conditional statments is **true**

c) If $1+1=3$, then $2+2=5$

⇒ " " " " 'false' and " "

" 'false' " " " " **true**

V.V.I **Note:** If hypothesis is "false" then always conditional statments is **true**

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d) If monkeys can fly, then 1+1=3

⇒ Since, the hypothesis is "false", the conditional statement is [true]

## Ans No: 29

State the converse, contrapositive and inverse of each of these conditional statements.

a) If it snows today, I will ski tomorrow.

Converse: "I will ski tomorrow only if it snows today."

Contrapositive: "If I do not ski tomorrow, then it will not have snowed today."

Inverse: "If it does not snow today, then I will not ski tomorrow."

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b) I come to class whenever there is going to be a quiz.

Converse: "If I come to class, then there will be a quiz."

Contrapositive: "If I do not come to class, then not there will be a quiz."

Inverse: "If there is not going to be a quiz, then I don't come to class."

c) A positive integer is a prime only if it has no divisors other than I and itself.

Converse: "A positive integer is a prime if it has no divisors other than I and itself"

Constrapositive: "If a positive integer has a divisor other than 1 and itself, then it is not prime."

Inverse: "If a positive integer is not prime, then it has a divisor other than I and itself."