Lecture Examples

Ex 1 Consider the following statements

p: I ran 3 miles this morning

q: You ran 3 miles this morning

(a) Give a symbolic representation of the following (natural language) sentences:

i. "You did not run 3 miles this morning."

$$\sim q$$

ii. "I did not run 3 miles this morning, but you ran 3 miles this morning."

$$(\sim p) \wedge q$$

iii. "It is not the case that both you and I ran 3 miles this morning."

$$\sim (p \wedge q)$$

(b) Give a natural language interpretation of the following symbolic sentences:

i. $p \wedge q$

You and I ran 3 miles this morning

ii. $p \wedge (\sim q)$

I ran 3 miles this morning, but you did not

Ex 2 Consider the following sentences

p: My friend from Connecticut visited me.

q: I went to Saddle Mountain.

r: It rained last week.

(a) Translate the following natural language sentences into symbolic statements:

i. "Either it rained last week or I went to Saddle Mountain."

$$r \vee q$$

ii. "If my friend from Connecticut visited me, then I didn't go to Saddle Mountain."

$$p \to (\sim q)$$

iii. "If I went to Saddle Mountain and my friend visited me, then it rained last week."

$$(q \wedge p) \to r$$

(b) Give a natural language interpretation of the following symbolic statements:

i. $p \vee (\sim r)$

My friend from Connecticut visited me or it didn't rain last week

ii. $(\sim p) \to r$

If my friend from Connecticut didn't visit me, then it rained last week.

iii. $p \wedge ((\sim r) \to q)$

My friend from Connecticut visited me and if it didn't rain last week, I went to Saddle Mountain

On-Your-Own Examples

Ex 1 Write a sentence that represents the negation of each statement.

(a) All children eat candy.

Some children don't eat candy

(b) Some students are vegetarian.

None of the students is vegetarian

(c) Some students do not play sports.

No students play sports

(d) No students play instruments.

Some students play instruments

Ex 2 Using the following symbolic representations

p: The car costs \$70,000
q: The car goes 140 mph
r: The car is red

express the following compound statements in symbolic form.

(a) All red cars go 140 mph.

$$r \rightarrow q$$

(b) The car is red, goes 140 mph, and does not cost \$70,000.

$$r \wedge q \wedge \sim p$$

(c) If the car does not cost \$70,000, it does not go 140 mph.

$$(\sim p) \rightarrow (\sim q)$$

(d) The car is red and it neither goes 140 mph nor costs \$70,000.

$$r \wedge \sim q \wedge \sim p$$

(e) Being able to go 140 mph is sufficient for a car to cost \$70,000 or be red.

$$q \rightarrow (p \vee r)$$

(f) Not being red is necessary for a car to cost \$70,000 and not go 140 mph.

$$(p \wedge (\sim q)) \rightarrow (\sim r)$$

Ex 3 True or False?

(a) Having a lottery ticket is sufficient for winning the lottery.

False

(b) Having a lottery ticket is necessary for winning the lottery.

True

Ex 4 Using the symbolic representations

        p: It is raining.

        q: The sun is shining.

        r: It is warm.

express the following in words.

(a) $p \wedge q$

It is raining and the sun is shining

(b) $p \wedge \sim q$

It is raining and the sun is not shining

(c) $p \rightarrow (\sim q \wedge \sim r)$

If it is raining, then the sun is not shining and it is not warm

(d) $r \rightarrow (\sim p \vee q)$

If it is warm, then either it is not raining or the sun is shining

Ex 5 Translate each sentence into symbolic form. Be sure to define each letter you use.

(a) Joyce will go to the movies or visit a friend.

    m: Joyce will go to the movies

    f: Joyce will visit a friend

        $m \vee f$

(b) Snow is sufficient for the game to be canceled.

    s: It is snowing

    g: The game will be canceled

        $s \rightarrow g$

(c) All right triangles are isosceles.

    t: It is a right triangle

    i: It is isosceles

        $t \rightarrow i$

(d) If Eric and Simon go on vacation, then Jesse will stay home.

    e: Eric goes on vacation

    s: Simon goes on vacation

    j: Jesse stays home

        $(e \wedge s) \rightarrow j$

(e) If the label does not read "poison" then it is safe to drink.

    p: the label reads "poison"

    d: It is safe to drink

        $(\sim p) \rightarrow d$

(f) I will not go out or I will wear a raincoat if it rains.

    o: I will go out

    c: I will wear a raincoat

    r: It rains

        $r \rightarrow (\sim o \vee c)$