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**Question no.15:** Let *p*, *q*, and *r* be the propositions

p : Grizzly bears have been seen in the area.

q : Hiking is safe on the trail.

r : Berries are ripe along the trail.

Write these propositions using p, q, and r and logical

connectives (including negations).

**a)** Berries are ripe along the trail, but grizzly bears have

not been seen in the area.

**b)** Grizzly bears have not been seen in the area and hiking

on the trail is safe, but berries are ripe along the

trail.

**c)** If berries are ripe along the trail, hiking is safe if and

only if grizzly bears have not been seen in the area.

**d)** It is not safe to hike on the trail, but grizzly bears have

not been seen in the area and the berries along the trail

are ripe.

**e)** For hiking on the trail to be safe, it is necessary but not

sufficient that berries not be ripe along the trail and

for grizzly bears not to have been seen in the area.

**f )** Hiking is not safe on the trail whenever grizzly bears

have been seen in the area and berries are ripe along

the trail.

Answer:

a) "But" is a logical synonym for "and" (although it often suggests that the second part of the sentence is

likely to be unexpected). So this is *r* A *--.p.*

**b)** Because of the agreement about precedence, we do not need parentheses in this expression: *--.p* A *q* A *r.*

c) The outermost structure here is the conditional statement, and the conclusion part of the conditional

statement is itself a biconditional: *r* -> ( *q* f-+ *--.p)* .

**d)** This is similar to part **(b):** *--.q* A *--.p* A *r.*

e) This one is a little tricky. The statement that the condition is necessary is a conditional statement in one

direction, and the statement that this condition is not sufficient is the negation of the conditional statement in

the other direction. Thus we have the structure (safe -> conditions) A--.( conditions -> safe). Fleshing this out

gives our answer: ( *q* -> *(--.r* A *--.p))* A --.( *(--.r* A *--.p)* -> *q).* There are some logically equivalent correct answers

as well.

**f)** We just need to remember that "whenever" means "if" in logic: *(p* A *r)* -> *--.q.*