Practice Problems with Negation, Conjunction, and Disjunction

Instructions:

a) Identify if the statement has structure using logical conjunction, disjunction negation or combinations of these. If it isn’t any of these, mark it as being simple.

b) If the statement is compound, separate the sentence into its independent statements and connect them into one long statement using ‘and,’ ‘or’ and ‘it is not the case that’, filling in the pronouns for clarity.

c) Assign a capital letter to represent each independent statement.

d) Using only the capital letters from c) and the ampersand symbol (&), the wedge (\(\lor\)) and the tilde (~), rewrite b).

Example Problem:

Neither Lorraine nor Ellen washed the dog.

Example Answer:

It is not the case that [either Lorraine washed the dog, or Ellen washed the dog.]

Let L = “Lorraine washed the dog.”
Let E = “Ellen washed the dog.”

\(~(L \lor E)\)

1. Rick either fell in love or he didn’t.

Either Rick fell in love, or it is not the case that Rick fell in love.

Let R = “Rick fell in love.”

R \lor \sim R

2. Erasing the tapes is either a bad idea or I’m missing something.

Either erasing the tapes is a bad idea, or I am missing something.

Let E = “Erasing the tapes is a bad idea.”
Let M = “I am missing something.”

E \lor M

3. Among Jessie, Duke, and Angela, at least one of them broke the glass.

Either Jessie broke the glass, or Duke broke the glass, or Angela broke the glass.

Let J = “Jessie broke the glass.”
Let D = “Duke broke the glass.”
Let A = “Angela broke the glass.”

\((J \lor D) \lor A\)

4. Kenny and Isis washed the dishes or their mother did.

(Kenny washed the dishes and Isis washed the dishes), or the mother of Kenny and Isis washed the dishes.”

Let K = “Kenny washed the dishes.”
Let I = “Isis washed the dishes.”
Let M = “The mother of Kenny and Isis washed the dishes.”

\((K \& I) \lor M)\)
5. Repairing a stereo just isn’t worth it; either it costs too much or the quality of the repair isn’t good enough.
   It is not the case that repairing a stereo is worth it, and either repairing a stereo costs too much, or it is not the case that the quality of the repair is good enough.
   Let W = “Repairing a stereo is worth it.”
   Let C = “Either repairing a stereo costs too much.”
   Let Q = “The quality of the repair is good enough.”
   \( \sim W \land (C \lor \sim Q) \)

6. Orlando offered tea or coffee to his guests.
   Orlando offered tea to Orlando’s guests, and Orlando offered coffee to Orlando’s guests.
   Let T = “Orlando offered tea to Orlando’s guests.”
   Let C = “Orlando offered coffee to Orlando’s guests.”
   \( T \land C \)

7. Realism is either a philosophy or a coping mechanism.
   Either realism is a philosophy, or realism is a coping mechanism.
   Let P = “Realism is a philosophy.”
   Let M = “Realism is a coping mechanism.”
   \( P \lor M \)

8. Neither time nor money will help her overcome this tragedy.
   It is not the case that (either time will help her overcome this tragedy, or money will help her overcome this tragedy).
   Let T = “Time will help her overcome this tragedy.”
   Let M = “Money will help her overcome this tragedy.”
   \( \sim (T \lor M) \)

9. Either Dave attended and Travis didn’t, or the other way around.
   Either (Dave attended, and it is not the case that Travis attended), or (Travis attended, and it is not the case that Dave attended.)
   Let D = “Dave attended.”
   Let T = “Travis attended.”
   \( (D \land \sim T) \lor (T \land \sim D) \)

10. It is incorrect that Rachel wants neither Saturday nor Sunday off.
    It is not the case that it is not the case that (either Rachel wants Saturday off, or Rachel wants Sunday off.)
    Let A = “Rachel wants Saturday off.”
    Let B = “Rachel wants Sunday off.”
    \( \sim (A \lor B) \)
Give the translation that best captures the meaning of the sentence.

S = Sonny works for the Don.
F = Frederico works for the Don.
M = Michael works for the Don.

C = Sonny is a confidential informant.
O = Frederico is a confidential informant.
N = Michael is a confidential informant.

A = Sonny has an alibi.
L = Frederico has an alibi.
I = Michael has an alibi.

Either Frederico has an alibi or he is a confidential informant.
(L ∨ O)

Sonny works for the Don, but he is either a confidential informant or he has an alibi.
S & (C ∨ A)

Either Sonny or Michael (but not both) works for the Don.
(S ∨ M) & ~(S & M)

Either Frederico or Michael is a confidential informant, but both have an alibi.
(O ∨ N) & (L & I)

Neither Sonny nor Frederico has an alibi, but neither work for the Don.
~(A ∨ L) & ~(S ∨ F)

Michael and Frederico have alibis, although only one of them works for the Don.
(I & L) & [(M ∨ F) & ~(M & F)]

Neither Michael nor Frederico are confidential informants, but both have an alibi.
~(N ∨ O) & (L & I)

Of the three sons, viz., Sonny, Frederico, and Michael: all work for the Don, and no one has a alibi.
[S & (F & M)] & ~[A & (~L & ~I)]
[S & (F & M)] & ~[A & ~(L ∨ I)]
[S & (F & M)] & ~(A ∨ (L ∨ I))
Michael works for the Don, but he is a confidential informant, and although Frederico also works for the Don, he has an alibi.

\[(M & N) & (F & L)\]

Either only Sonny and Michael or only Sonny and Frederico work for the Don.

\[\[(S & M) v (S & F)] & \sim[S & (F & M)]\]