UNIT 2: SYMBOLIZATION EXERCISES 1

Negation and Conditional

Symbolize each of the following sentences using the abbreviation scheme provided:

P: The Toronto Maple Leafs win.
Q: The Washington Capitals win.
R: The Vancouver Canucks win.
S: The Edmonton Oilers win.
T: A member of the team is injured.
U: Somebody gets suspended for taking performance enhancing drugs.
V: The Vancouver Canucks will make the playoffs.
W: The Washington Capitals will make the playoffs.
X: The Toronto Maple Leafs will win the Stanley Cup.
Y: The Washington Capitals will win the Stanley Cup.

2.01 The Edmonton Oilers don't win. $\sim S$

2.02 It's not the case that the Maple Leafs don't win. $\sim\sim P$

2.03 The Washington Capitals will not fail to make the playoffs. $\sim\sim W$

2.04 Given that the Vancouver Canucks win, they will make the playoffs. $R \rightarrow V$

2.05 The Maple Leafs will win only on condition that the Oilers don't. $P \rightarrow \sim S$

2.06 The Canucks won't make the playoffs if somebody gets suspended for taking performance enhancing drugs. $U \rightarrow \sim V$

2.07 The Capitals will make the playoffs only provided that no member of the team is injured. $W \rightarrow \sim T$

2.08 It is necessary that the Canucks win in order for them to make the playoffs. $V \rightarrow R$

2.09 Only if the Canucks don't make the playoffs will the Capitals win the Stanley Cup. $Y \rightarrow \sim V$

2.10 Whenever a member of the team gets injured the Capitals fail to make the playoffs. $T \rightarrow \sim W$

2.11 It's not true that if the Capitals don't win they will not make the playoffs. $\sim(\sim Q \rightarrow \sim W)$

2.12 Only if it is not the case that the Oilers win will the Canucks fail to make the playoffs. $\sim V \rightarrow \sim S$

2.13 Assuming the Canucks don't make the playoffs, the Maple Leafs will win the Stanley Cup only if the Capitals don't. $\sim V \rightarrow (X \rightarrow \sim Y)$

2.14 If the Capitals will make the playoffs if nobody gets suspended for taking performance enhancing drugs, then they will win the Stanley Cup. $(\sim U \rightarrow W) \rightarrow Y$

2.15 Provided that the Oilers don't win, the Canucks will if they don't fail to make the playoffs. $(\sim S \rightarrow (\sim\sim V \rightarrow R))$

2.16 The Oilers won't win, assuming the Capitals will if the Maple Leafs won't. $(\sim P \rightarrow Q) \rightarrow \sim S$

P: It will snow.
Q: It will hail.
R: It will rain.
S: The sun will come out.
T: The temperature will drop below freezing.
U: It will snow all day and all night.
V: The highways will be closed.
W: School will be cancelled.
X: There is a rainbow

$(P \rightarrow U) \rightarrow W$

2.17 School will be cancelled provided that if it snows, it snows all day and all night.

$(P \rightarrow T) \rightarrow \sim(U \rightarrow V)$

2.18 If it is necessary that the temperature drop below freezing for it to snow, then it is not sufficient for the highways to be closed that it snow all day and all night.

2.19 The sun will not come out if it snows, assuming that the temperature drops below freezing. $T \rightarrow (P \rightarrow \sim S)$

2.20 If it rains, there won't be a rainbow unless the sun comes out. $R \rightarrow (\sim S \rightarrow \sim X)$

2.21 If it rains it will not hail, only on the condition that the temperature doesn't drop below freezing. $(R \rightarrow \sim Q) \rightarrow \sim T$

2.22 School won't be cancelled unless the highways are closed. $(W \rightarrow V)$

2.23 It is not the case that if it snows all day and all night school will be cancelled. $\sim(U \rightarrow W)$

2.24 Only if the temperature fails to drop below zero will the sun come out, provided that it doesn't rain. $(R \rightarrow \sim Q) \rightarrow \sim T$

2.25 Assuming that it won't rain if it snows all day and all night, school will be cancelled only on the condition that the highways will be closed. $(U \rightarrow \sim R) \rightarrow (W \rightarrow V)$

2.26 If the temperature drops below freezing only if the sun doesn't come out, then it snows only if it doesn't rain. $(T \rightarrow \sim S) \rightarrow (P \rightarrow \sim R)$

2.27 Provided that it rains, there will be a rainbow if the sun comes out.

$R \rightarrow (S \rightarrow X)$

2.28 That the sun come out is a necessary condition for there being a rainbow, only if it is necessary for rain that the temperature not drop below freezing. $(X \rightarrow S) \rightarrow (R \rightarrow \sim T)$

2.29 Only if it is not the case that it fails to rain, will it not hail provided the temperature doesn't drop below freezing. $(\sim T \rightarrow \sim Q) \rightarrow \sim\sim R$

2.30 It is not the case that the sun won't come out, that is, provided it snows if the temperature drops below freezing. $(T \rightarrow P) \rightarrow \sim\sim S$

2.31 If only if it rains it doesn't snow, there will be a rainbow only if the sun doesn't fail to come out. $(\sim P \rightarrow R) \rightarrow (X \rightarrow \sim\sim S)$

The last few sentences to symbolize are ambiguous – they mean different things depending on how you parse them. Symbolize them in different ways to disambiguate them. There are two different ways for 32 and 33, and five different ways for 34.

P: The students listen to the lectures..
Q: The students will learn.
R: The professor is boring.

$\sim(R \rightarrow P)$
$P \rightarrow \sim R$

2.32 It is not the case that the students listen to the lectures if the professor is boring. (Symbolize in two logically distinct ways)

2.33 The students will learn only if they listen to the lectures provided that the professor is not boring. (Symbolize in two logically distinct ways.)

$\sim R \rightarrow (Q \rightarrow P)$
$Q \rightarrow (\sim R \rightarrow P)$

2.34 It is not the case that the students will learn if they don't listen to the lectures assuming that the professor is not boring. (Symbolize in five logically distinct ways.)

$\sim(\sim R \rightarrow (\sim P \rightarrow Q))$

It is not the case that (assuming that the professor is not boring, if they don't listen to the lectures then the students will learn.)

$\sim((\sim R \rightarrow \sim P) \rightarrow Q)$

It is not the case that (if (assuming that the professor is not boring they don't listen to the lectures) then the students will learn.

$\sim R \rightarrow (\sim P \rightarrow \sim Q)$

Assuming that the professor is not boring then (it is not the case that (the students will learn if they don't listen to the lectures.))

$\sim R \rightarrow \sim(\sim P \rightarrow Q)$

Assuming that the professor is not boring then (if they don't listen to the lectures then it is not the case that the students will learn.

$(\sim R \rightarrow \sim P) \rightarrow \sim Q$

If, (if the professor is not boring, the students don't listen to the lectures), then it is not the case that the students will learn.