# Quiz #3

PHIL-205-01:Symbolic Logic

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09/18/2021

## 1 Section 1: Translations in Truth Functional Logic

Using the following symbolization key, please symbolize the following sentences.

$B$: Your shifters aren't compatible with 12 speeds in the back.
$C$: Campagnolo doesn't offer a 52T cog.
$F$: Bikes really are "machines for freedom".
$M$: You need a monster cog in the back.
$O$: You ought to install a 1x drivetrain on your bike.
$S$: You're better off with a Shimano drivetrain.
$V$: You can find a vintage SunTour derailleur on eBay.

1. You ought to install a 1x drivetrain on your bike only if you need a monster cog in the back.

$$O \implies M \tag{1}$$

2. If you need a monster cog in the back but Compagnolo doesn't offer a 52T cog, then you're better off with a Shimano drivetrain.

$$(M \wedge C) \implies S \tag{2}$$

3. Either your shifters aren't compatible with 12 speeds in the back and you ought to install a 1x drivetrain on your bike, or Campagnolo doesn't offer a 52T cog and you're better off with a Shimano drivetrain.

$$(B \wedge O) \vee (C \wedge S) \tag{3}$$

4. You ought to install a 1x drivetrain on your bike if either Campagnolo doesn't offer a 52T cog or your shifters aren't compatible with 12 speeds in the back (but not both).

$$(\neg[C \iff B]) \implies O \tag{4}$$

5. If a) you're better off with a Shimano drivetrain only if your shifters aren't compatible with 12 speeds in the back, and b) you ought to install a 1x drivetrain on your bike unless you cannot find a vintage SunTour derailleur on eBay, then bikes really are "machines of freedom" only if you don't need a monster cog in the back.

$$([B \implies S] \wedge [O \vee V]) \implies (M \implies F) \tag{5}$$

## 2 Section 2: Translation in First Order Logic

Using the following symbolization key symbolize the following sentences.

Domain: Songs
$Cx$: x was written by Tracy Chapman
$Sx$: x is, without a doubt, one of the best songs of the 1980s
$Bx$: x was recently covered by Black Pumas
$f$: "Fast Car"

1. "Fast Car" is, without a doubt, one of the best songs of the 1980s if and only if it was recently covered by Black Pumas.

$$Sf \iff Bf \tag{6}$$

2. Tracy Chapman wrote a song that is, without a doubt, one of the best songs of the 1980s.

$$\exists x(Cx \wedge Sx) \tag{7}$$

3. Black Pumas recently covered a Tracy Chapman song that is, without a doubt, one of the best songs of the 1980s.

$$\exists x(Cx \wedge Sx \wedge Bx) \tag{8}$$

4. Every song recently covered by Black Pumas was written by Tracy Chapman.

$$\forall x(Bx \implies Cx) \tag{9}$$

5. Not every song recently covered by Black Pumas was written by Tracy Chapman.

$$\neg(\forall x[Bx \implies Cx]) \tag{10}$$

6. No song recently covered by Black Pumas was written by Tracy Chapman.

$$\neg(\exists x[Bx \wedge Cx]) \tag{11}$$

7. If Black Pumas recently covered a song that is, without a doubt, one of the best songs of the 1980s, then "Fast Car" is, without a doubt, one of the best songs of the 1980s.

$$\exists x(Bx \wedge Sx) \implies Sf \tag{12}$$

8. Either "Fast Car" was not recently covered by Black Pumas, or there's a song that is, without a doubt, neither one of the best songs of 1980s not written by Tracy Chapman.

$$Bf \vee (\exists x[(\neg Sx) \wedge (\neg Cx)]) \tag{13}$$

# 3 Section 3: Truth Table

Is the following a valid argument?

$$\begin{aligned} & P \wedge R \\ & \neg R \vee Q \\ \therefore\ & P \implies Q \end{aligned} \tag{14}$$

| $P$ | $Q$ | $R$ | $P \wedge R$ | | | $\neg R \vee Q$ | | | $P \implies Q$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |

There are two lines in the truth table where the conclusion is false. In both of these lines, the premises are not both true. Therefore, this argument is valid.