

Symbolization in TFL

Symbolize the following sentences. Please be sure to supply a symbolization key indicating the meanings of your sentence letters.

Boolean Connectives

1. Harry is shorter than Ron, but he is smarter.
2. George, who is president, is smarter than Spot (a dog), and he's older as well.
3. Ozzie took drugs and got sick.
4. Ben and J.Lo don't love each other, and they aren't married.
5. Lennon was shot by Chapmann, but Oswald didn't shoot Kennedy.
6. It isn't true that Kennedy was smarter than Lennon, but while Kennedy was president, Lennon took drugs.
7. Lennon was neither a president nor politician, and he wasn't loved by J.Lo either.
8. Although George is a president, he isn't a president who loves J.Lo.
9. Either George loves Spot or Spot loves both George and Ben.
10. Lennon either loved Oswald or Kennedy, but not both.

Either not P or not Q	$(\neg P \vee \neg Q)$
Neither P nor Q	$\neg(P \vee Q) \text{ or } (\neg P \wedge \neg Q)$
Both not P and not Q	$(\neg P \wedge \neg Q)$
Not both P and Q	$\neg(P \wedge Q)$
Either P and Q or R	$((P \wedge Q) \vee R)$
P and either Q or R	$(P \wedge (Q \vee R))$

Conditionals and Biconditionals

1. If James is a doctor, then he's only poorer than Bob if Bob is a professional athlete.
2. Her writing a dissertation is a necessary condition for Mary receiving a PhD, but it's not a sufficient condition.
3. Arnold will be governor only if both Gray is recalled and Arnold receives the most votes.
4. π is transcendental if and only if e is as well.
5. If Jill dropped Fluffy, then it landed on its feet if it was a cat.
6. OJ's murdering his wife is a sufficient condition for OJ going to jail, unless OJ is rich and famous.
7. Supposing that π is transcendental, it would follow that either $(e + \pi)$ or $(e \cdot \pi)$ is irrational.
8. If Bill is taller than Mary, then Mary is taller than Vinny only if Vinny is short.
9. It's false that Joe's buying a lottery ticket is a necessary condition for his winning the lottery.
10. Bobby Fisher is a genius if and only if his living in the Philippines and not being allowed to return to the U.S. is a sufficient condition for making him a genius.
11. Bill was a good president, provided that he didn't inhale; unless he had an affair with Monica.
12. If Kripke attends the party, then Humphreys will leave if Barcan attends.
13. Either Bill is taller than Monica only if he's older than her, or Bill's being taller than Monica is a necessary condition for his being older than her.
14. If his eating a burger is a sufficient condition for Joe to be overweight, then Joe is overweight.
15. Beckham loves Posh only if Posh loves both Beckham and football.

$A \rightarrow B$	$B \rightarrow A$	$\sim B \rightarrow A$	$A \leftrightarrow B$
If A then B A only if B A is a sufficient condition for B	A provided that B A given that B A in case of B A assuming that B A on the condition that B A is a necessary condition for B A if B	A unless B	A if and only if B A just in case B (sometimes) A in exactly the same circumstances as B