Equivalences of Temporal Properties

19CSE205 : PROGRAM REASONING

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Contents

1. ¬ G p = F ¬ p

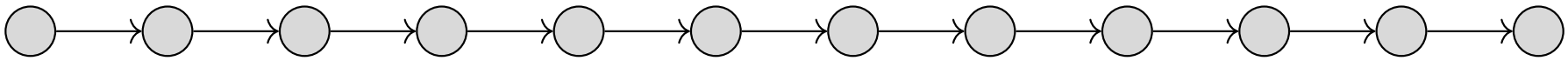
- p is not globally true
- There is at least one state where p is false

2. ¬ F p = G ¬ p

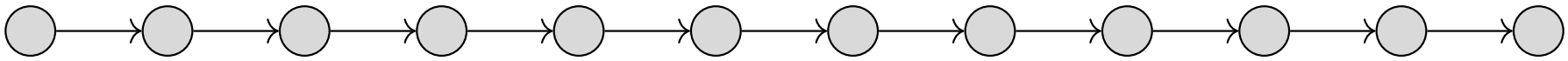
- p is not true in any future
- Globally p is false

X in the presence of U, $\wedge$ and $\vee$

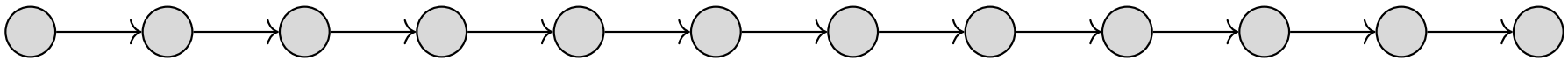
3. Is $\neg X\ p = X\ \neg p$ true?



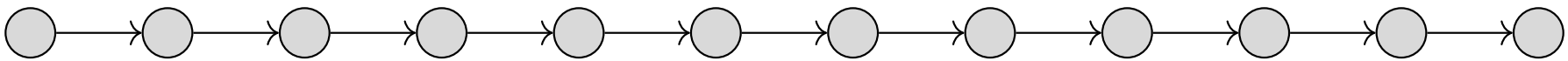
4. Is $X\ (p \wedge q) = X\ p \wedge X\ q$ true?



5. Is $X\ (p \vee q) = X\ p \vee X\ q$ true?

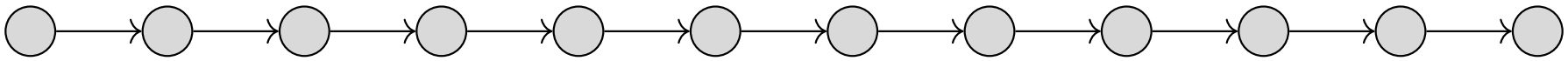


6. Is $X\ (p\ U\ q) = X\ p\ U\ X\ q$ true?

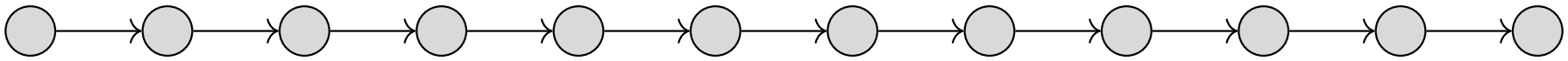


F and G in the presence of $\wedge$ and $\vee$

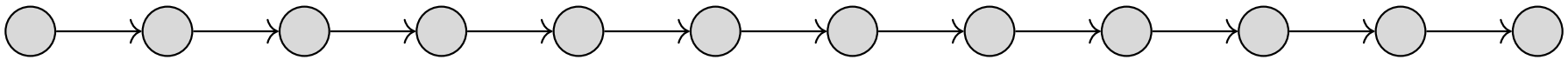
7. Is $F\ (p \vee q) = F\ p \vee F\ q$ true?



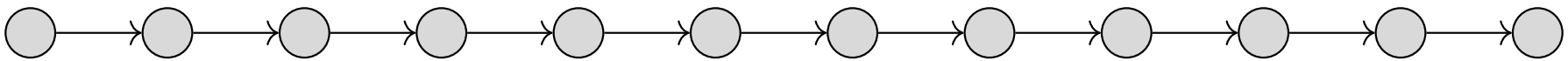
8. Is $F\ (p \wedge q) = F\ p \wedge F\ q$ true?



9. Is $G\ (p \wedge q) = G\ p \wedge G\ q$ true?

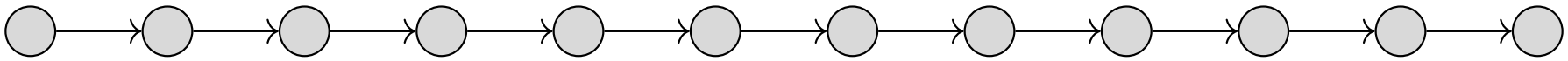


10. Is $G\ (p \vee q) = G\ p \vee G\ q$ true?

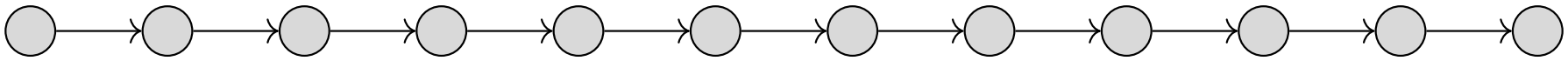


U in the presence of $\wedge$ and $\vee$

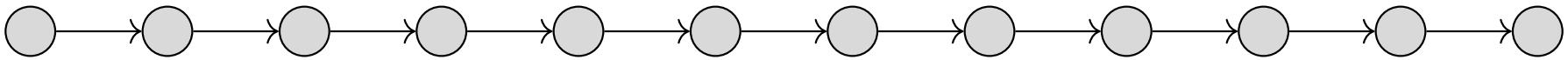
11. Is $p\ U\ (q \vee r) = (p\ U\ q) \vee (p\ U\ r)$ true?



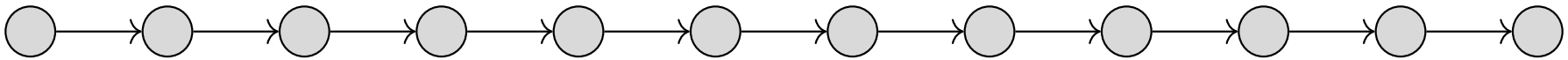
12. Is $p\ U\ (q \wedge r) = (p\ U\ q) \wedge (p\ U\ r)$ true?



13. Is $(p \wedge q)\ U\ r = (p\ U\ r) \wedge (q\ U\ r)$ true?

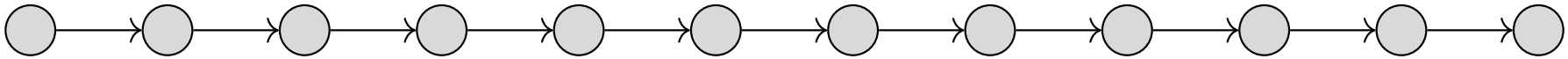


14. Is $(p \vee q)\ U\ r = (p\ U\ r) \vee (q\ U\ r)$ true?

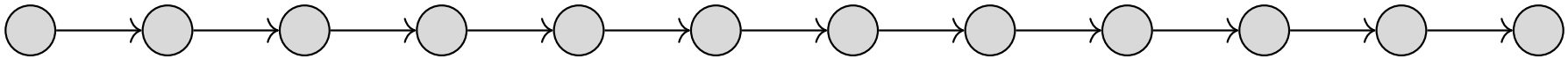


U and R connection

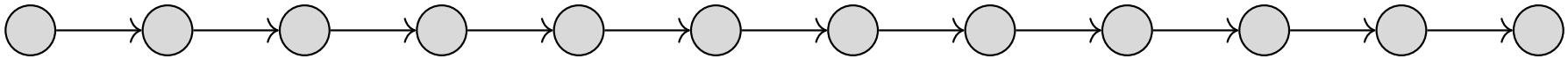
15. $\neg (p\ U\ q) = (\neg\ p\ R\ \neg\ q)$



16. $\neg (p\ R\ q) = (\neg\ p\ U\ \neg\ q)$



17. $F\ p = F\ F\ p$



18. $G\ p = G\ G\ p$