

Determine if the following statements are valid or invalid. State your reasoning.

1. $\overset{F}{\text{If you are 16 years old, then you have a part-time job.}} \longrightarrow \overset{F?}{\text{You are 15 years old.}} \quad \text{Invalid}$
 You do not have a part-time job.

2. $\overset{F?}{\text{In April it is either raining or cold.}} \equiv \overset{F}{\text{It is not cold.}} \quad \text{Invalid}$
 It is not raining.

3. $\overset{(F)}{\overset{T?}{\text{If I run the marathon, then I will get to the finish line faster.}}} \longrightarrow \overset{T}{\text{I got to the finish line fast.}} \quad \text{Invalid}$
 I ran the marathon.

4. $\text{If you speed, then you will get a ticket. If you speed, then you will lose your license. If you get a ticket, then you will lose your license.} \quad \text{Invalid}$

5. $\overset{(T)}{\overset{F?}{\text{If you travel to Washington D.C., then you will visit the Washington Monument.}}} \quad \overset{F}{\text{You did not visit the Washington Monument. You did not travel to Washington D.C.}} \quad \text{Valid}$

6. $\overset{T}{\text{If Monday is Halloween, then kids will go trick-or-treating.}} \quad \overset{(F)}{\overset{T?}{\text{Monday is Halloween. Kids will go trick-or-treating.}}} \quad \text{Valid}$

7. $\text{If you go to PTHS, then you live in Washington County. If you live in Washington County, then you live south of Pittsburgh. If you go to PTHS, then you live south of Pittsburgh.} \quad \text{Valid}$

8. $\overset{(T)}{\overset{F?}{\text{If a figure is a circle, then it is not a polygon.}}} \quad \overset{F}{\text{The figure is a polygon. The figure is not a circle.}} \quad \text{valid}$

9. $\overset{F}{a \rightarrow b} \quad \overset{(T)}{\overset{F?}{\sim a}} \quad \text{Invalid}$
 $\frac{\sim a}{\therefore \sim b}$

10. $\overset{(T)}{\overset{F?}{s \rightarrow t}} \quad \overset{F}{\sim t} \quad \text{Valid}$
 $\frac{\sim t}{\therefore \sim s}$

11. $\overset{(T)}{\overset{F?}{x \text{ or } y}} \quad \overset{T}{y} \quad \text{Invalid}$
 $\frac{y}{\therefore \sim x}$

12. $\overset{T}{p \rightarrow q} \quad \overset{(F)}{\overset{T?}{p}} \quad \text{valid}$
 $\frac{p}{\therefore q}$

13. $x \rightarrow y$
 $\frac{x \rightarrow z}{\therefore y \rightarrow z} \quad \text{Invalid}$

14. $\overset{(F)}{\overset{T?}{c \rightarrow d}} \quad \overset{T}{d} \quad \text{Invalid}$
 $\frac{d}{\therefore c}$