

## 5.10: Exercises

### Boolean Logic

For questions 1-2, list the set of integers that satisfy the given conditions.

1. A positive multiple of 5 and not a multiple of 2
2. Greater than 12 and less than or equal to 18

### Quantified Statements

For questions 3-4, write the negation of each quantified statement.

3. Everyone failed the quiz today.
4. Someone in the car needs to use the restroom.

### Truth Tables

5. Translate each statement from symbolic notation into English sentences. Let  $A$  represent "Elvis is alive" and let  $G$  represent "Elvis gained weight".

- a.  $A \vee G$
- b.  $\sim (A \wedge G)$
- c.  $G \rightarrow \sim A$
- d.  $A \leftrightarrow \sim G$

For questions 6-9, create a truth table for each statement.

6.  $A \wedge \sim B$
7.  $\sim (\sim A \vee B)$
8.  $(A \wedge B) \rightarrow C$
9.  $(A \vee B) \rightarrow \sim C$

Questions 10-13: In this lesson, we have been studying the inclusive or, which allows both  $A$  and  $B$  to be true. The exclusive or does not allow both to be true; it translates to "either  $A$  or  $B$ , but not both."

10. For each situation, decide whether the "or" is most likely exclusive or inclusive.

- a. An entrée at a restaurant includes soup or a salad.
- b. You should bring an umbrella or a raincoat with you.
- c. We can keep driving on I-5 or get on I-405 at the next exit.
- d. You should save this document on your computer or a flash drive.

11. Complete the truth table for the exclusive or.

$A$	$B$	$A \vee B$
T	T	
T	F	
F	T	
F	F	

12. Complete the truth table for  $(A \vee B) \wedge \sim (A \wedge B)$ .

$A$	$B$	$A \vee B$	$A \wedge B$	$\sim (A \wedge B)$	$(A \vee B) \wedge \sim (A \wedge B)$
T	T				
T	F				
F	T				
F	F				

13. Compare your answers for questions 11 and 12. Can you explain the similarities?

### Conditional Statements

14. Consider the statement “If you are under age 17, then you cannot attend this movie.”

- Write the converse.
- Write the inverse.
- Write the contrapositive.

15. Assume that the statement “If you swear, then you will get your mouth washed out with soap” is true. Which of the following statements must also be true?

- If you don’t swear, then you won’t get your mouth washed out with soap.
- If you don’t get your mouth washed out with soap, then you didn’t swear.
- If you get your mouth washed out with soap, then you swore.

For questions 16-18, write the negation of each conditional statement.

16. If you don’t look both ways before crossing the street, then you will get hit by a car.

17. If Luke faces Vader, then Obi-Wan cannot interfere.

18. If you weren’t talking, then you wouldn’t have missed the instructions.

19. Assume that the biconditional statement “You will play in the game if and only if you attend all practices this week” is true. Which of the following situations could happen?

- You attended all practices this week and didn’t play in the game.
- You didn’t attend all practices this week and played in the game.
- You didn’t attend all practices this week and didn’t play in the game.

### De Morgan’s Laws

For questions 20-21, use De Morgan’s Laws to rewrite each conjunction as a disjunction, or each disjunction as a conjunction.

20. It is not true that Tina likes Sprite or 7-Up.

21. It is not the case that you need a dated receipt and your credit card to return this item.

22. Go back and look at the truth tables in Exercises 6 & 7. Explain why the results are identical.

### Deductive Arguments

For questions 23-28, use a Venn diagram or truth table or common form of an argument to decide whether each argument is valid or invalid.

23. If a person is on this reality show, they must be self-absorbed. Laura is not self-absorbed. Therefore, Laura cannot be on this reality show.

24. If you are a triathlete, then you have outstanding endurance. LeBron James is not a triathlete. Therefore, LeBron does not have outstanding endurance.

25. Jamie must scrub the toilets or hose down the garbage cans. Jamie refuses to scrub the toilets. Therefore, Jamie will hose down the garbage cans.

26. Some of these kids are rude. Jimmy is one of these kids. Therefore, Jimmy is rude!

27. Every student brought a pencil or a pen. Marcie brought a pencil. Therefore, Marcie did not bring a pen.

28. If a creature is a chimpanzee, then it is a primate. If a creature is a primate, then it is a mammal. Bobo is a mammal. Therefore, Bobo is a chimpanzee.

### Logical Fallacies

For questions 28-31, name the type of logical fallacy being used.

29. If you don’t want to drive from Boston to New York, then you will have to take the train.

30. New England Patriots quarterback Tom Brady likes his footballs slightly underinflated. The “Cheatriots” have a history of bending or breaking the rules, so Brady must have told the equipment manager to make sure that the footballs were underinflated.
31. Whenever our smoke detector beeps, my kids eat cereal for dinner. The loud beeping sound must make them want to eat cereal for some reason.

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