

Kerry Ojakian's CSI 30 Class
Class Assignment #1

1. Which of the following statements are propositions? What are the truth values of those that are propositions?

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| (a) Do not cheat! | (d) Bronx Community College. |
| (b) When is class over? | |
| (c) There is a roach in this room. | (e) Honey never rots. |

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2. Which of the following statements are propositions? What are the truth values of those that are propositions?

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| (a) $x + y = 4$ | (c) $6 - 8 > 0$ |
| (b) $3 + 1 = 4$ | (d) $x = 9$ |

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3. Which of the following statements are propositions? What are the truth values of those that are propositions?

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| (a) All integers are positive. | (c) A negative integer is less than a positive integers. |
| (b) All numbers are interesting. | (d) There is a largest integer. |
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4. Let P and Q be the propositions:

P : Vic lives in California

Q : Vic likes beer

Express each of these propositions as an English sentence.

(a) $\neg P$

(c) $Q \leftrightarrow P$

(b) $P \rightarrow Q$

(d) $P \vee \neg Q$

5. Let P and Q be the propositions:

B : I am a student at BCC.

M : I live in Manhattan.

Express each of these propositions as an English sentence and state whether it is true or false *for you*.

(a) B

(c) $B \vee M$

(b) $B \wedge M$

(d) $\neg B \vee M$

6. Let P and Q be the propositions:

P : I am a student at BCC.

Q : I am a student at CUNY.

Express each of these propositions as an English sentence and state whether it is true or false *for anyone saying it (not just you)*.

(a) $P \wedge Q$

(c) $Q \rightarrow P$

(b) $P \rightarrow Q$

(d) $P \vee \neg P$

7. Let P , Q , and R be the following propositions

P : You do all the homework.

Q : You attend every class.

R : You get an A in this class.

Write these propositions using P , Q , and R , along with the logical connectives.

- (a) You do all the homework, but you do not attend every class.
- (b) You get an A in the class, attend every class, and do all the homework.
- (c) If you do all the homework, and attend every class, then you will get an A in this class.

8. Determine whether each of these conditional statements is true or false.

- (a) If $1 + 1 = 2$, then Trump is president of the USA.
- (c) If $1 + 1 < 5$, then $2 + 2 = 5$.
- (b) If $1 + 1 = 3$, then Rihanna is president
- (d) If $1 + 1$ is negative, then $2 + 2 = 5$.

9. How many rows appear in a truth table for each of these compound propositions?

- (a) $X \vee \neg X$
- (c) $(P \vee \neg Q) \leftrightarrow ((P \wedge Q) \rightarrow \neg P)$
- (b) $A \rightarrow (A \wedge \neg B)$
- (d) $(A \vee B) \rightarrow (A \vee B \wedge \neg C)$

10. Construct a truth table for the following proposition: $X \vee \neg X$

11. Construct a truth table for the following proposition: $\neg A \wedge B$

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12. Construct a truth table for the following proposition: $\neg A \rightarrow (A \vee \neg B)$

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13. Show that the following proposition is a tautology (using a truth table):

$$A \leftrightarrow B \equiv (A \rightarrow B) \wedge (B \rightarrow A)$$

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14. Show that the following proposition is a tautology (just giving an argument in English without using a truth table): $A \rightarrow (A \vee B)$
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15. Show that the following proposition is a contradiction (just giving an argument in English without using a truth table): $P \leftrightarrow \neg P$
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16. Find an example of a conditional statement in propositional logic which is a tautology.
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17. Show that the following 2 propositions are **not** logically equivalent: $(A \rightarrow B) \rightarrow C$ and $A \rightarrow (B \rightarrow C)$
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18. Consider the following proposition: $A \vee B \wedge C$. Make 2 different choices of placing parentheses, so that you get 2 propositions which are **not** logically equivalent.
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19. We know that $\neg\neg P$ is equivalent to P . More generally, if we build up a proposition using only the letter P and the negation symbol, which of these propositions are equivalent to P ?

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20. Use De Morgan's laws to find the negation of each of the following statements.

- (a) Jose is smart and rich.
- (b) Mary takes the subway to BCC or walks to BCC

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21. Use De Morgan's laws to find the negation of each of the following statements.

- (a) $A \vee \neg B$
 - (b) Mary takes the subway to BCC or walks to BCC
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