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CS 2150/ Professor Westcott

Chapter 1.1 Exercises

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1. Which of these sentences are propositions? What are the truth values of those that are propositions?

* 1. Boston is the capital of Massachusetts
  2. Miami is the capital of Florida
  3. 2 + 3 = 5
  4. 5 + 7 = 10
  5. x + 2 = 11
  6. Answer this questions.

Answer:

Propositions – a, b, c, d

True Propositions – a, c

3. What is the negation of each of these propositions?

* 1. Linda is younger than Sanjay
  2. Mei makes more money than Isabella
  3. Moshe is taller than Monica
  4. Abby is richer than Ricardo

Answer:

1. Linda is **not** younger than Sanjay
2. Mei does **not** make more money than Isabella
3. Moshe is **not** taller than Monica
4. Abby is **not** richer than Ricardo

5. What is the negation of each of these propositions?

1. Mei has an MP3 player.
2. There is no pollution in New Jersey
3. 2 + 1 = 3
4. The summer in Maine is hot and sunny.

Answer:

1. Mei does **not** have an MP3 player.
2. There is pollution in New Jersey
3. 2 + 1 ≠ 3
4. The summer in Maine is **not** hot or it is **not** sunny.

7. What is the negation of each of these propositions?

1. Steve has more than 100 GB free disk space on his laptop.
2. Zach blocks emails and texts from Jennifer.
3. 7 \* 11 \* 13 = 999
4. Diane rode her bicycle 100 miles on Sunday.

Answer:

1. Steve does **not** have more than 100 GB free disk space on his laptop.
2. Zach does **not** block emails and texts from Jennifer.
3. 7 \* 11 \* 13 ≠ 999
4. Diane did **not** ride her bicycle 100 miles on Sunday.

13. Let *p* and *q* be the propositions

*p*: It is below freezing

*q*: It is snowing

Write these propositions using *p* and *q* and logical connectives (including negations).

1. It is below freezing and snowing.
2. It is below freezing but not snowing
3. It is not below freezing and it is not snowing
4. It is either snowing or below freezing (or both)
5. If it is below freezing, it is also snowing
6. Either it is below freezing or it is snowing, but it is not snowing if it is below freezing.
7. That it is below freezing is necessary and sufficient for it to be snowing.

Answer:

1. *p q*
2. *p q*
3. *p q*
4. *p*  V *q*
5. *p*  *q*
6. *(p*  v *q)*  (*p*  ­­­­­­­­­­­­­*q*)
7. *q ←→ p*

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

1. If 1 + 1 = 2, then 2 + 2 = 5
2. If 1 + 1 = 3, then 2 + 2 = 4
3. If 1 + 1 =3, then 2 + 2 = 5.
4. If monkeys can fly, then 1 + 1 = 3

Answer:

1. False
2. True
3. True
4. True

21. For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended. Explain your answer

1. Coffee or tea comes with dinner
2. A password must have at least 3 digits or be at least eight characters long
3. The prerequisite for the course is a course in number theory or a course in cryptography.
4. You can pay using U.S. dollars or euros.

Answer:

1. Exclusive Or – Only get one drink
2. Inclusive Or – Longer passwords can include the 3 digits.
3. Inclusive Or – Student but is only expected to have taken at least one prerequisite course.
4. Both – Most of the time you choose one currency to choose, however either you must use both or the store doesn’t except foreign currency.

29. State the converse, contrapositive, and inverse of each of these conditional statements.

1. If it snows today, I will ski tomorrow
2. I come to class whenever there is going to be a quiz
3. A positive integer is a prime only if it has no divisors other than 1 and itself

Answer:

1. Converse: If I ski tomorrow, then it snowed today

Contrapositive: If I do not ski tomorrow, then it did not snow today

Inverse: If it does not snow today, then I will not ski tomorrow

1. Converse: If I come to class, then there will be a quiz

Contrapositive: If I did not come to class, then there was no quiz.

Inverse: If there is not going to be a quiz, then I will not come to class.

1. Converse: If a positive integer has no divisors other than 1 and itself, then it is a prime

Contrapositive: If it has a divisor other than 1 and itself, then it is not a prime

Inverse: If a positive integer is not a prime, then it has some divisor other than 1 and itself.

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

1. *p* *p*
2. (*p V r*) (*q V s*)
3. *q* V *p* V *s* V *r* V *t* V *u*
4. (*p*  r *t*) ←→ (*q* *t*)

Answer:

* 1. 1 variable → = 2 rows

1. 4 variables → = 16 rows
2. 6 variables → = 64 rows
3. 4 variables → = 16 rows

35. Construct the truth table for each of these compound propositions.

1. (p V q) (p q)
2. (p q) (p q)
3. (p V q) (p q)
4. (d ←→ q) (p ←→ q)
5. (p ←→ q) (p ←→ r)
6. (p q) (p q)

Answer:

|  |  |  |
| --- | --- | --- |
| p | q | (p V q) (p q) |
| T | T | F |
| T | F | T |
| F | T | T |
| F | F | T |

|  |  |  |
| --- | --- | --- |
| p | q | (p q) (p q) |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

|  |  |  |
| --- | --- | --- |
| p | q | (p V q) (p q) |
| T | T | F |
| T | F | T |
| F | T | T |
| F | F | F |

|  |  |  |
| --- | --- | --- |
| p | q | (p ←→ q) (p ←→ q) |
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | T |

|  |  |  |  |
| --- | --- | --- | --- |
| p | q | r | (p ←→ q) (p ←→ r) |
| T | T | T | F |
| T | T | F | T |
| T | F | T | T |
| T | F | F | F |
| F | T | T | F |
| F | T | F | T |
| F | F | T | T |
| F | F | F | F |

|  |  |  |
| --- | --- | --- |
| p | q | (p q) (p q) |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |