Team Identification Block

Author 1: Ms. Fiona Faultless
Student ID: *00000001
E-Mail: ffaultless@uco.edu
CRN: 11128 Autumn 2019
Author 2: Ms. Petunia Perfect
Student ID: *00000000
E-Mail: pperfect@uco.edu
CRN: 12234 Autumn 2019
Course: CMSC 2123 – Discrete Structures
Assignment: a01
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Scoring block			
Exercise	**Maximum**	**Earned**	**Explanation**
1	1	1	
3	1	1	
5	1	1	
7	1	1	
Total	**4**	**4**	

1. Which of these sentences are propositions? What are the truth values of those that are propositions?
   a) Boston is the capital of Massachusetts.
   b) Miami is the capital of Florida.
   c) $2 + 3 = 5$
   d) $5 + 7 = 10$
   e) $x + 2 = 11$
   f) Answer this question.

   Answer:

Question	Proposition	Truth Value	Explanation
a	Yes	T	The proposition is a statement of fact that can be tested.
b	Yes	F	The proposition is a statement of fact that can be tested.
c	Yes	T	The proposition is an arithmetic identity that can be tested.
d	Yes	F	The proposition is an arithmetic identity that can be tested.
e	No		The equation has infinitely many solutions that are true and infinitely many solutions that are false. A proposition can have only one truth value.
f	No		The proposition is a command and has no truth value.

3. What is the negation of each of these propositions?
   a) Today is Thursday.
   b) There is no pollution in New Jersey.
   c) $2 + 1 = 3$.
   d) The summer in Maine is hot and sunny.

   Answer:

Question	Statement	Negation
a	Today is Thursday.	Today is not Thursday.
b	There is no pollution in New Jersey.	There is pollution in New Jersey.
c	$2 + 1 = 3$.	$2 + 1 \neq 3$.
d	The summer in Maine is hot and sunny.	The summer in Maine is not hot or it is not sunny.

5. Let p and q be the propositions
   p: Swimming at the New Jersey shore is allowed.
   q: Sharks have been spotted near the shore.
   Express each of these propositions as an English sentence.
   a) $\neg q$
   b) $p \wedge q$
   c) $\neg p \vee q$
   d) $p \rightarrow \neg q$
   e) $\neg q \rightarrow p$
   f) $\neg p \rightarrow \neg q$
   g) $p \leftrightarrow \neg q$
   h) $\neg p \wedge (p \vee \neg q)$

   Answer:

Question	Proposition	English Equivalent
a	$\neg q$	Sharks have not been spotted near the shore.
b	$p \wedge q$	Swimming at the New Jersey shore is allowed and sharks have been spotted near the shore.
c	$\neg p \vee q$	Swimming at the New Jersey shore is not allowed or Sharks have been spotted near the shore.
d	$p \rightarrow \neg q$	If swimming at the New Jersey shore is allowed then Sharks have not been spotted near the shore.
e	$\neg q \rightarrow p$	If sharks have not been spotted near the shore then swimming at the New Jersey shore is allowed.
f	$\neg p \rightarrow \neg q$	If swimming at the New Jersey shore is not allowed then sharks have not been spotted near the shore.
g	$p \leftrightarrow \neg q$	Swimming at the New Jersey shore is allowed if and only if sharks have not been spotted near the shore.
h	$\neg p \wedge (p \vee \neg q)$	Swimming at the New Jersey shore is not allowed and, either swimming at the New Jersey shore is allowed or sharks have not been spotted near the shore.

7. 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.

Answer:

Question	English Proposition	Mathematical Equivalent
a	It is below freezing and snowing.	$p \wedge q$
b	It is below freezing but not snowing.	$p \wedge \neg q$
c	It is not below freezing and not snowing.	$\neg p \wedge \neg q$
d	It is either snowing or below freezing (or both).	$q \vee p$
e	If it is below freezing, it is also snowing.	$p \rightarrow q$
f	If is either below freezing or it is snowing, but it is not snowing if it is below freezing.	$q \wedge \neg p$
g	That it is below freezing is necessary and sufficient for it to be snowing.	$q \rightarrow p$