Southern New Hampshire University

MAT 230 Module Two Homework

General:

- Before beginning this homework, be sure to read the textbook sections and the material in Module Two.
- Type your solutions into this document and be sure to show all steps for arriving at your solution. Just giving a final number may not receive full credit.
- You may copy and paste mathematical symbols from the statements of the questions into your solution. This document was created using the Arial Unicode font.
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1) State whether each of the following is a statement or is not a statement and explain why. If it is a statement, give its truth value.
   a) Drink more water.
      Is a declarative sentence (command) but not a statement.
   b) Paris is the capital city of the United States of America.
      Is a statement but it's false because Paris is not the capital city of United States.
   c) Is it going to rain tomorrow?
      This is a question not a statement.

   This problem is similar to Example 1 and to Exercise 1 in Section 2.1 of your SNHU MAT230 textbook.

2) Consider the two propositions.
   p: We can buy a book.
   q: We can go to a restaurant.

   Write each of the following statements in symbolic notation and as English sentences.
   a) The conjunction (∧) of p and q.
      $p \wedge q$: We can buy a book **and** we can go to a restaurant.
   b) The disjunction (∨) of p and q.
      $p \vee q$: We can buy a book **or** we can go to a restaurant.
   c) The negation (~) of the conjunction (∧) of p and q.
      $\sim p \wedge \sim q$: We can not buy a book **and** we can not go to a restaurant.
   d) The negation (~) of the disjunction (∨) of p and q.
      $\sim p \vee \sim q$: We can not buy a book **or** we can not go to a restaurant.

   This problem is similar to Examples 2–4 and to Exercises 5 and 10 in Section 2.1 of your SNHU MAT230 textbook.

3) Write the statement **"Every number is more than its reciprocal"** symbolically by first defining a predicate and then using a quantifier.
   This problem is similar to Example 8 and to Exercise 18 in Section 2.1 of your SNHU MAT230 textbook.
   P(X)= for every number x, x > 1/x

4) Let P(n): $n^2 = n + 6$.
   a) What is P(2) as a statement?

   b) What is P(3) as a statement?

   c) What is the truth value of $\forall n$ P(n)?

   d) What is the truth value of $\exists n$ P(n)?

   This problem is similar to Examples 8 and 9 and to Exercises 19, 20, and 21 in Section 2.1 of your SNHU MAT230 textbook.

5) Complete a truth table for **(p ∧ ~q) ∨ (~p ∧ q)**. There are multiple ways to set up the columns of a truth table, so you may need fewer or more columns than shown.

p	q	$p \rightarrow q$	~q	~p	$\sim q \Rightarrow \sim p$	$(p \wedge \sim q) \vee (\sim p \wedge q$
T	T	T	F	F	T	T
T	F	F	T	F	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	T

This problem is similar to Example 5 and to Exercises 27–30 in Section 2.1 of your SNHU MAT230 textbook.

6) Use the following:
   p: I will watch TV.
   q: I have finished my homework.
   Write each of the following statements in **terms of p, q, and logical connectives.**
   a) I will watch TV if I have finished my homework.
      $p \Rightarrow q$
   b) I will watch TV only if I have not finished my homework.
      $q \Leftrightarrow p$
   c) I will watch TV is a necessary condition for I have finished my homework.
      $q \Rightarrow p$
   d) I will not watch TV is a sufficient condition for I have finished my homework.
      $\sim p \Rightarrow q$
   e) I will watch TV if and only if I have finished my homework.
      $p \Leftrightarrow q$

   This problem is similar to Example 1 and to Exercises 1 and 2 in Section 2.2 of your SNHU MAT230 textbook. **You may want to use the symbols ⇒, ⇍, or ⇔.**

7) Consider the following statement: **If it is Friday, then Emily will go to the museum.**
   I will let **p:** If it is Friday and **q:** Emily will go to the museum
   a) Write the **contrapositive** of that statement.
      $\sim q \Rightarrow \sim p$
      Emily won't go to the museum, then it is not Friday.
   b) Write the **converse** of that statement.
      $q \Rightarrow p$
      Emily will go to the museum, then if it is Friday.

   This problem is similar to Example 2 and to Exercises 3 and 4 in Section 2.2 of your SNHU MAT230 textbook.

8) Construct a truth table for **$(p \wedge q) \Rightarrow (p \vee q)$.** Explain how this truth table **shows whether this statement is a tautology, a contradiction (absurdity), or a contingency.**
This problem is similar to Example 5 and to Exercises 10–12 in Section 2.2 of your SNHU MAT230 textbook.

p	q	$p \Leftrightarrow q$	~q	~p	$\sim q \Leftrightarrow \sim p$	$(p \wedge q) \Rightarrow (p \vee q)$
T	T	T	F	F	T	T
T	F	F	T	F	F	T
F	T	F	F	T	T	T
F	F	T	T	T	T	T

This is a tautology??? Am I correct?

9) Write each of the arguments below symbolically and then explain whether it is valid or not.

a) If it is hot outside, then I will go swimming.
I will not go swimming.
∴ It is not hot outside.
$p \Rightarrow q$
$q \Rightarrow p$

∴ $p \Leftrightarrow q$ Both arguments are valid

b) If it is not hot outside or if it is raining, then I will not go swimming.
It is not raining.
∴ I will not go swimming.
$\sim q \Rightarrow \sim p$
$\sim p \Rightarrow \sim q$

∴

c) I will go swimming if and only if it is hot outside.
I will not go swimming.
∴ It is not hot outside.

This problem is similar to Examples 2–5 and to Exercises 1–9 in Section 2.3 of your SNHU MAT230 textbook.

10) Prove or disprove that if the **product of two numbers (in ℕ) is even,** then at least one of them must be even.
This problem is similar to Examples 8 and 9 and to Exercises 13–18 in Section 2.3 of your SNHU MAT230 textbook.

11) Prove or disprove that if **the sum of two numbers (in ℕ) is even,** then at least one of them must be even.
This problem is similar to Examples 8 and 9 and to Exercises 23–26 in Section 2.3 of your SNHU MAT230 textbook.