

# Math 163 – Test #1: Form A

October 23, 2015  
Instructor: Patricia Wrean

Name: \_\_\_\_\_

Total: 40 points

---

1. Let  $A = \{1, 3, 5, 7\}$ ,  $B = \{1, 3, 5, 7, \dots\}$ , and  $U = \{x / x \text{ is an odd integer}\}$ . State whether the following are T (true) or F (false). (6 points)

a)  $A \cup B = A$  \_\_\_\_\_

b)  $B = U$  \_\_\_\_\_

c)  $A \subseteq A$  \_\_\_\_\_

d)  $\emptyset \subset B$  \_\_\_\_\_

e)  $\bar{A} = \{9, 11, 13, \dots\}$  \_\_\_\_\_

f)  $\{-1\} \in U$  \_\_\_\_\_

2. Let  $p$  denote “John took the bus to work” and  $q$  denote “John walked home.” Rewrite the following English sentences in terms of logical symbols (i.e.  $p \wedge q$ ,  $p \vee q$ ). Do not simplify! (4 points)

a) John walked home or he didn't take the bus to work. \_\_\_\_\_

b) Either John didn't take the bus to work or he didn't walk home but not both. \_\_\_\_\_

c) It is not true that John both took the bus to work and walked home. \_\_\_\_\_

d) John walked home or he didn't walk home. \_\_\_\_\_

3. For the pair of sentences below, is the second the negation of the first? (2 points)

a) The number of keys on Pat's keyring is positive. Pat has no keys on her keyring. \_\_\_\_\_

b) Many students were late for class. No students were late for class. \_\_\_\_\_

4. Consider the sets  $U = \{1, 2, 3, 4, 5, 6\}$ ,  $A = \{1, 4\}$ , and  $B = \{4, 5, 6\}$ . Each part is only worth one point, so you don't need to show any work. (4 points)

a) Find  $\bar{B}$ . \_\_\_\_\_

b) Find  $\bar{A} \cup \bar{B}$ . \_\_\_\_\_

c) Find  $\overline{A \cap B}$ . \_\_\_\_\_

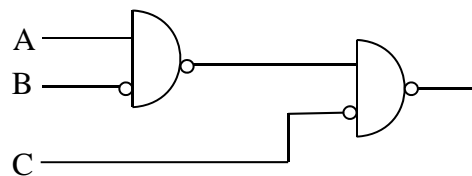
d) Find  $B \cap \emptyset$ . \_\_\_\_\_

5. Answer the following questions with "Yes", "No", or "Maybe". (2 points)

a) Larry blogs daily or answers his email. Does he blog daily? \_\_\_\_\_

b) Frank ordered soup and salad. Did he order soup or salad? \_\_\_\_\_

6. Write the Boolean expression that corresponds to the following gate diagram. Do not simplify! (3 points)

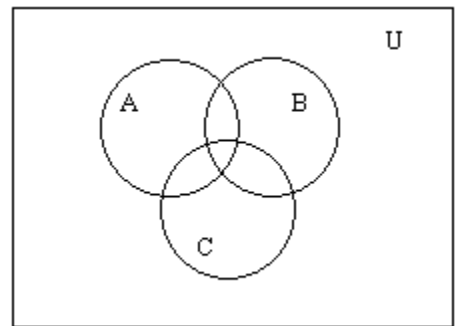


\_\_\_\_\_

7. List all of the proper subsets of the set  $\{1, 2\}$ . (2 points)

\_\_\_\_\_

8. Represent  $\overline{A \cap (B \cup C)}$  on the following Venn diagram by shading in the appropriate regions. Show intermediate steps on separate sketches and label them clearly to get full credit. (5 points)



9. Consider the sets  $U = \{1, 2, 3, \dots, 10\}$ ,  $A = \{1, 2, 3, 6, 9\}$ , and  $B = \{2, 4, 6, 8, 9\}$ . Use the **computer representation of sets** to find the following. To get full credit, you must show your work. (5 points)

$$\overline{\overline{A \cap B} \cup A}$$

For the questions on this page: if you are using the Laws of Logic, remember to use one law of logic per line, and be sure to state the name of the law you are using!

10. Prove that the following Boolean expressions are equivalent by using the laws of logic. If you're stuck, try using a truth table for part marks. (5 points)

$$A + \overline{A+B} = A + \overline{B}C + \overline{B}\overline{C}$$

11. Simplify the following. This is the nasty question I promised you and credit will only be awarded if the laws of logic are used to simplify the expression. (2 points)

$$\overline{\overline{\overline{p \vee q \vee q \vee p}}}$$