

**MATH 170**  
**EXAM 01**

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UNIVERSITY OF SOUTH CAROLINA

Answer the questions in the spaces provided on the question sheets and turn them in at the end of the class period. If you require extra space, use the back of the page and indicate that you have done so.  
Unless otherwise stated, all supporting work is required. Unsupported or otherwise mysterious answers will **not receive credit**.

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

Problem	Points Earned	Points Possible
1		10
2		20
3		12
4		18
5		20
6		20
Bonus		10
Total		100

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*Date:* February 26, 2016.

**1** (10 Points). *Let  $S$  be the set of all students at the University of South Carolina. Let  $A$  be the subset of all students taking Math 170 this semester. Let  $B$  be the subset of all students not majoring in business.*

*(a) In words, what does the set  $A \cup B$  represent?*

*(b) In words, what does the set  $A \cap B$  represent?*

*(c) In words, what do the sets  $S \setminus A$  and  $S \setminus B$  represent?*

*(d) In words, what does the set  $(S \setminus A) \cap (S \setminus B)$  represent?*

*(e) In words, what does the set  $(S \setminus A) \cup (S \setminus B)$  represent?*

**2** (20 Points). *A bag contains three red marbles, two green marbles, one lavender marbles, one yellow marble, and one orange marble. The marbles are all distinguishable.*

*(a) How many sets of four marbles include none of the red ones?*

*(b) How many sets of four marbles include exactly one red marble?*

**3** (12 Points). *How many two letter sequences can be made using the six letters*  
 *$q, u, a, k, e$ ?*

Let  $U = \{A, B, C, D, E, F, G\}$ . Let  $X = \{B, D, F\}$ ,  $Y = \{A, F, G\}$ , and  $Z = \{A, B, E, G\}$ . Use these sets to answer problems 4 and 5.

**4** (18 Points). *Compute*

(a)  $X \cap Y$ ,

(b)  $X \cup Z$ ,

(c) *The complement of  $Z$  in  $U$ ,  $U \setminus Z$ .*

**5** (20 Points). (a) *What is the cardinality of  $X \times Z$ ?*

(b) *What is the cardinality of  $Y \cup Z$ ?*

**6** (20 Points). *Use a truth table to prove the following logical equivalences.*

(a)

$$\neg p \vee q \equiv \neg q \implies \neg p.$$

(b)

$$p \wedge (p \vee q) \equiv p.$$

**7** (Bonus - 10 Points). *Write out Modus Tollens symbolically. State the conditions for an argument to be valid and then prove that Modus Tollens is a valid argument. Can you give an example of how Modus Tollens is used?*