Patterns in Mathematics (012-01)
First Exam
Spring 2015

Please do all work on this paper. Points are written to the left of each problem,

8 pts 1. Let $A = \{1, 2, 3\}$, $B = \{3, 2, 1\}$, and $C = \{1, 2, 3, 4\}$. Answer True or False.

(a) $A = B$.

(b) $A \subseteq C$.

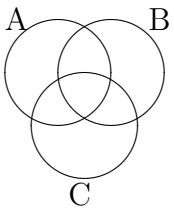
(c) $A \times B = \{(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$.

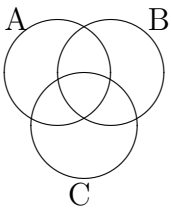
(d) $A \cap C = A$.

10 pts 2. Give an example of a set that has exactly 32 subsets. (You do not need to list the subsets.)

/28

10 pts 3. In the following Venn diagram, shade $(A \cap C) \cup B$. (I'm giving you two copies in case you mess one up. Circle the diagram you want me to grade.)





24 pts 4. Let $D = \{1, 2, 4\}$, $E = \{2, 3, 4, 5\}$, and $F = \{5, 6, 7\}$.

(a) $D \cap E =$

(b) $(D \cap E) \times F =$

(c) $D \cap F =$

(d) $D \cap (E \cup F) =$

/44

20 pts 5. Identify each of the following as a negation, disjunction, conjunction, or conditional. (A conditional statement is also called an implication.)

(a) $\sim P \to Q \vee R$

(b) $\sim (P \to Q) \vee R$

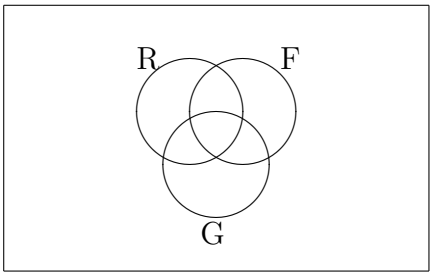
(c) $\sim (P \to Q \vee R)$

(d) $(\sim P \to Q) \vee R$

12 pts 6. Out of a group of 100 students, 20 took a Russian class, 35 took a French class, 33 took a German class, 5 took both Russian and French, 7 took both Russian and German, 6 took both French and German, and 2 took all three languages.

(a) How many students took just one of these foreign languages?

(b) How many of the 100 students did not take any of these languages?



/28

16 pts 8. Fill in the following truth tables. In each case, circle the column with the final truth values for the given statement.

P	Q	$\sim (P \wedge \sim Q)$
T	T	
T	F	
F	T	
F	F	

P	Q	R	$Q \rightarrow (P \vee R)$
T	T	T	
T	T	F	
T	F	T	
T	F	F	
F	T	T	
F	T	F	
F	F	T	
F	F	F	