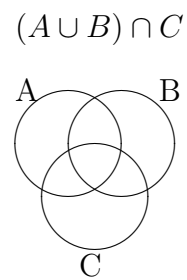
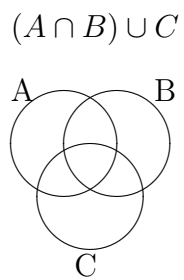


Patterns in Mathematics (012-01)
Final Exam
Spring 2013

Please do all work on this paper. Each problem is worth 20 points.

1. Shade the sets indicated in the following Venn diagrams.



2. A jar has 3 red balls and one blue ball. Three balls are drawn without replacement. What is the probability that one of them is blue?

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

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

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

4. Let S be the statement “*the sun is shining*” and let R be the statement “*it is raining*”. Consider the following argument:

Either the sun is shining or it is not raining.

It is not raining.

Therefore the sun is shining.

Use a truth table to determine the validity of this argument. (You will get no points for stating your conclusion without filling in the relevant truth table.)

S	R	
T	T	
T	F	
F	T	
F	F	

5. Fifteen students are in a room. Five of them are taking both a math class and a physics class. Seven of them are taking a math class. Eight of them are taking a physics class. If you pick a student in the room at random, what is the probability that the student is taking neither a math class nor a physics class?

6. $2,037,420 = 2^2 \cdot 3^3 \cdot 5 \cdot 7^3 \cdot 11$ and $1,433,250 = 2 \cdot 3^2 \cdot 5^3 \cdot 7^2 \cdot 13$. Find the greatest common divisor of 2,037,420 and 1,433,250. (You write the solution as a product of primes.)

7. (a) Convert 23_{four} to base ten.

(b) Convert 143_{ten} to base six.

8. Compute
$$\begin{array}{r} 242_{\text{five}} \\ \times 14_{\text{five}} \\ \hline \end{array}$$

9. Convert the hexadecimal number $A73B_{\text{sixteen}}$ to base two (binary).

10. (a) Write $\frac{5}{11}$ as a decimal. (Show your work. No credit will be given for the answer without work shown.)

(b) Write $2.\overline{23}$ as a quotient of integers.