CISC-102 WINTER 2016

HOMEWORK 2

Please work on these problems and be prepared to share your solutions with classmates in class next Friday. Assignments will \underline{not} be collected for grading.

READINGS

Read sections 1.6, 1.7, 1.8 of Schaum's Outline of Discrete Mathematics.

Read sections 1.1, 1.2 and 1.3 again (If you did not understand things last week) of *Discrete Mathematics Elementary and Beyond*.

Problems

- (1) Illustrate DeMorgan's Law $(A \cap B)^c = A^c \cup B^c$ using Venn diagrams.
- (2) Observe that $A \subseteq B$ has the same meaning as $A \cap B = A$. Draw a Venn diagram to illustrate this fact.
- (3) Use a Venn diagram to show that if $A \subseteq B$ and $B \subseteq C$, then $A \subseteq C$.
- (4) Use the Principle of Exclusion and Inclusion to show that $|A \cup B| + |A \cap B| = |A| + |B|$. (It may help your understanding if you first explore an example such as $A = \{1,2,3\}$ and $B = \{3,4\}$.)
- (5) What are the cardinalities of the following sets?
 - (a) $A = \{$ winter, spring, summer, fall $\}$.
 - (b) $B = \{x : x \in \mathbb{Z}, 0 < x < 7\}.$
 - (c) P(B), that is, the power set of B.
 - (d) C = { $x : x \in \mathbb{N}, x \text{ is even }$ }.
- (6) Suppose that we have a sample of 100 students at Queen's who take at least one of the following language courses, French-101, Spanish-101, German-101. Also suppose that 65 take French-101, 45 take German-101, 42 take Spanish 101, 20 take French-101 and German-101, 25 take French-101 and Spanish-101, and 15 take German-101 and Spanish-101.
 - (a) How many students take all three language courses? (HINT: Use the Principle of Inclusion and Exclusion to write an expression representing these students and the classes they take.)
 - (b) Draw a Venn diagram representing these 100 students and fill in the regions with the correct number.
 - (c) How many students take exactly 1 of these courses?
 - (d) How many students take exactly 2 of these courses?
- (7) Let $S = \{a, b, c, d, e, f, g\}$. Determine which of the following are partitions of S:
 - (a) $P1 = \{\{a,c,e\},\{b\},\{d,g\}\}$

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- (b) $P2 = \{\{a,b,e,g\},\{c\},\{d,f\}\}$
- (c) $P3 = \{\{a,e,g\},\{c,d\},\{b,e,f\}\}$
- (d) $P4 = \{\{a, b, c, d, e, f, g\}\}$
- (8) Recall that the union operation is associative, that is $A \cup (B \cup C) = (A \cup B) \cup C$. Show that the relative complement set operation is not associative, that is, $A \setminus (B \setminus C) = (A \setminus B) \setminus C$, is incorrect for some sets A, B, C. (Note if relative complement is associative then the equation must be true for all sets A, B, C.)

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