MAE 106: ASSIGNMENT 5

Quiz: 28 October 2016.

(1) (Kohar 3.7.6) Table 1 gives the number of homicides, by city, in Canada for 2012 and 2013. List the elements of each set.

TABLE 1. Homicides, by city, Canada, 2012 and 2013

Cities	2012	2013
Toronto	81	79
Montréal	47	43
Winnipeg	33	26
Vancouver	37	42
Hamilton	6	15
Ottawa	7	9
Kingston	0	1

   (a) The set of cities where the number of homicides increased from 2012 to 2013.
   (b) The set of cities that had more than 30 homicides in 2012 or 2013.
   (c) The set of cities that had less than 9 homicides in 2012 and 2013.
   (d) The set of cities that had a decrease of 3 homicides or more from 2012 to 2013.

(2) (Kohar 3.4.5) Of the 130 students who took a discrete mathematics examination, 90 correctly answered the first question, 60 correctly answered the second question, and 50 correctly answered both questions. How many students
   (a) correctly answered either the first or second question?
   (b) did not answer either of the two questions correctly?
   (c) answered either the first or the second question correctly, but not both?
   (d) answered the second question correctly, but not the first?
   (e) missed the second question?

(3) Write the Principle of Inclusion and Exclusion for four sets: A, B, C, and D. In other words, what is the formula for $n(A \cup B \cup C \cup D)$?

Date: 14 October 2016.

(4) A survey of students who subscribe to certain YouTube channels produced the following data:
- 60% subscribe to LastWeekTonight
- 50% subscribe to Big Think
- 50% subscribe to Radio-Canada
- 30% subscribe to LastWeekTonight and Big Think
- 20% subscribe to Big Think and Radio-Canada
- 30% subscribe to LastWeekTonight and Radio-Canada
- 10% subscribe to all three shows.

What percentage of students subscribe to
(a) at least one of these shows?
(b) none of these programs?
(c) LastWeekTonight and Big Think, but not Radio-Canada?
(d) exactly two of these shows?

(5) (Kohar 3.4.11) After a rough lacrosse game, it was reported in a newspaper that of the 10 players on the team, 8 hurt a hip, 6 hurt a hand, 5 hurt a knee, 3 hurt both a hip and a hand, 2 hurt both a hip and a knee, 2 hurt both a hand and a knee, and none hurt all three. The reporter was promptly fired. Why?

(6) In a recent poll of 193 Americans, the following information was collected about the recent election:
- 140 of those polled are professionals
- 84 are under 30 years of age
- 133 plan to vote for the Democratic Party
- 56 were professionals under the age of 30 years old
- 41 of those under 30 plan to vote for the Democratic Party
- 111 professionals plan to vote for the Democratic Party
- 36 of the professionals under 30 plan to vote for the Democratic Party

Of those polled, how many non-professionals aged 30 or over plan to not vote for the Democratic Party?

(7) (Kohar 5.2.2) The student bar has 5 main dishes with meat and 6 without meat. How many possible single main dishes can be ordered?

(8) (Kohar 5.2.3) If a dime and a quarter are tossed, in how many ways can they land?

(9) (Kohar 5.2.8) Sterling is planning to travel from Toronto to Halifax. If he can travel from his home in Toronto to Ottawa by car, bus or train, and then from Ottawa to Halifax by train or plane, then how many possible itineraries are there? Use a tree diagram to illustrate Sterling's possible itineraries.

(10) (Kohar 5.2.10) Suppose you are given the digits $\{0, 1, 2, 3, 4, 5, 6\}$. How many three digit numbers can be formed if
(a) repetition of digits is allowed?
(b) the three digit number must be an odd number and repetition is not allowed.

(11) A van holds ten people. How many ways can ten people be seated in the minivan if
   (a) there are no restrictions?
   (b) only 3 people can drive?

(12) (Kohar 5.2.22) In Misa's wardrobe, she has five shirts, six skirts, seven pairs of pants, and eight dresses. Misa can select either a skirt or a pair of pants to go with a shirt, or she can wear only a dress. How many outfits can Misa create?

(13) (Kohar 5.2.23) A user's password to a university's computer network consists of four letters from the alphabet followed by 3 or 4 digits. Find the total number of passwords
   (a) that can be created;
   (b) that can be created in which no digit repeats; and
   (c) that can be created in which no letter repeats.

(14) (Kohar 5.2.25) In MAE 106 with n students, each student is given a choice of either one of x different logic problems, or one of y different counting problems. How many different ways can the students select the problems?

(15) Compute the following expressions.
   (a) $\dfrac{7!}{4!}$
   (b) $\dfrac{400!}{399!}$

(16) Express the following using factorials.
   (a) $6 \times 5 \times 3 \times 2 \times 1$
   (b) $\dfrac{20 \times 19 \times 18}{4 \times 3 \times 2 \times 1}$

(17) Express $(n+3)(n+2)!$ as a single factorial.

(18) Write the set $A = \{x \in \mathbb{N} \mid x! \leq 10\,000\}$ using roster notation.

(19) A 6-volume encyclopedia is placed on a shelf. How many incorrect arrangements are there?

(20) Seven people are invited to a murder mystery dinner, and they are all seated around a circular table. How many permutations exist for the seating order around the table?

(21) The members of Kingston City Council are to vote either *yes* or *no* (but not both) on each of seven issues. In marking a ballot, each councilor has the option of abstaining on as many as six of the issues, but cannot abstain on all seven issues. In how many ways can a ballot be marked? [Ans: 2186]