Math 201-813 Final exam May 2009

1. Answer True (T) if the statement is always true, otherwise answer False (F). **(10)**

a) A numerical value summarizing all the data of an entire population is called a **statistic** _____

b) If A and B are independent events, then $P(A \cup B) = P(A) + P(B) - P(A)P(B)$ _____

c) In a **binomial distribution** $\mu = np \text{ and } \sigma = \sqrt{npq}$ _____

d) The **Central Limit Theorem** says that the sampling distribution of $\bar{x}$ will more closely resemble the Normal distribution as the sample size increases _____

e) If a random variable Z is **the standard normal score**, then $Z(0.05) = P_{95}$ _____

f) The **Poisson** distribution of the random variable x has equal mean and variance _____

g) If A and B are mutually exclusive events, then $P(A \cap B) \neq 0$ _____

h) If A and B are mutually exclusive events, then they are also independent _____

i) In any probability distribution, and for all x, $\sum p(x) = 1$ _____

j) If the random variable $x = 0, 1, 2, 3, 4, ..., 10$, then x is a **continuous** random variable _____

2. Twenty randomly selected college students were asked to give the number of hours they socialize each week. These are the responses:

5, 6, 6, 8, 7, 7, 9, 5, 4, 8, 11, 6, 7, 8, 5, 6, 9, 10, 8, 8

a) Rank the data and find the mean, the median, the mode, the range, and the standard deviation. **(6)**

b) Give the 5-number summary, and draw a Box and Whisker plot to summarize the data. **(6)**

3. The grouped frequency distribution below gives the ages of a random sample of 300 adults who shop on the internet.

Class boundaries (age)	Frequency f
18 – 26	78
26 – 34	75
34 – 42	48
42 – 50	39
50 – 58	33
58 – 66	27

a) Find the mean age and std. dev. of this sample **(5)**

b) Construct a histogram and ogive for these data. **(6)**

4. A drawer contains 6 socks, 4 blue and 2 black. Simon randomly selects 2 socks from the drawer to wear to school. **(6)**

a) How many different 2 sock combinations can Simon select ?

b) What is the probability that Simon selects the 2 black socks ?

c) What is the probability that Simon will not wear matching socks to school ?

5. Three players I, II, III, play the game ' Old Man Out'. All three flip a coin and the winner is the player whose coin shows a face different from the other two players. If all three coins land on the same face, nobody wins. **(6)**

a) Write the sample space for a single game of 'Old Man Out'. Clearly indicate the game result for each possible outcome.

b) What is the probability that player I wins a single game ?

c) If they play 10 games, what is the probability that player I wins exactly 4 of those games ?

6. a) Given the function $f(x)=\frac{2x+1}{10},\ x=0,1,2,3$, is this a probability distribution function ? Justify your answer. **(2)**

b) For the probability distribution below, find the mean and std. dev. **(4)**

x	$P(x)$
2	0.1
3	0.2
4	0.3
5	0.4

7. a) Given $P(A)=0.3,\ P(B)=0.8$, are *A* and *B* mutually exclusive ? Explain. **(2)**

b) Given $P(A)=0.4,\ P(B|A)=0.5$, find $P(A\cap B)$. Furthermore, if A and B are independent, what is $P(B)$? **(4)**

8. BIXI (a mix of bicycle and taxi) is Montreal's new bike sharing program. A recent survey polled 200 Montrealers asking them if they plan on using BIXI. 140 said **YES** and 60 said **NO**. Construct a 99 % confidence interval for the true proportion of Montrealers who plan on using BIXI **(6)**

9. One hundred people were asked if they were left-handed or right-handed. The results are presented in the table below. **(3)**

	left – handed	*right – handed*	*total*
Male	9		52
Female	4		48
Total	13		100

(You must complete the table first)

One person is selected at random from this group.

a) What is the probability that this person is right-handed ?

b) What is the probability that this person is right-handed and female ?

c) Given the person is left-handed, what is the probability that this person is male ?

10. a) $P(-1.67 < z < 0) =$ _____ **(4)**

b) $P(z > 2.57) =$ _____

c) $z(0.02) =$ _____

d) $t\ (12,\ 0.05) =$ _____

11. In Montreal, 20 % of the population have a certain hair color. 15 Montrealers are randomly selected. **(6)**

What is the probability that:
a) Exactly 2 of them have that hair color ?

b) None of them have that hair color ?

c) At most 2 of them have that hair color ?

12. A report in Infant News stated that the mean cost per week for daycare in Montreal is \$120. If the std. dev. σ is known to be \$20, find the probability that a sample of 50 daycare centers would show a mean cost per week of less than \$100. (Assume daycare cost is normally distributed)

(3)

13. The number of complaints that a laundry service establishment receives per day is a randon variable having a Poisson distribution with mean $\mu = 3.2$. Find the probability that on any given day, it will receive **(4)**

a) Only 3 complaints

b) At most one complaint

The length of 200 salmon caught in a particular lake had a mean of 14 inches. The population std. dev. is $\sigma = 2.5$ inches. **(6)**

a) Find the std. error of the mean

b) Construct a 95 % confidence interval for the population mean.

14. An engineering school has designed a new standard test for mechanical aptitude. Scores on this test are normally distributed with a mean of 400 and a std. dev. of 60. If a subject is randomly selected and tested, what is the probability that his / her score will be between 385 and 425 ? **(4)**

A random sample of 41 students at CJA were asked about the cost of bus fare x in \$ per week. The sample data can be summarized as follows: **(6)**

$$\sum x = 550 \qquad \sum \left(x - \bar{x}\right)^2 = 200$$

a) Find the sample mean and sample std. dev.

b) Construct a 90 % confidence interval to estimate the true mean for bus fare per week for students at CJA.