MAT 1371
Final Exam

Professor G. Lamothe

Duration: 3 hours

Student Number: _____

Name: _____

- **This is a closed book examination. However two sheets (double-sided) are permitted.**
- **Only non-programmable and non-graphic calculators are permitted.**
- **The exam will be marked on a total of 50 points.**

1. **[10 points]** For the following multiple choice questions, please put your answers in the following table.

Question	a	b	c	d	e
Answer					

Question	f	g	h	i	j
Answer					

(a) A regression analysis of students' college grade point averages (GPA) and their high school GPAs found $r^2 = 0.311$. Which of the following is true?

I. High school GPA accounts for 31.1% of college GPA.
II. 31.1% of college GPAs can be correctly predicted with this model.
III. 31.1% of the variability in college GPA can be accounted for by the model.

A) I only B) II only C) III only D) None of the above

(b) School administrators collect data on students attending the school. Which of the following variables is quantitative?

A) whether the student is in AP classes
B) class (grade 1, 2, 3, or 4)
C) grade point average
D) whether the student has taken a particular standardized test

(c) Suppose your local school district decides to randomly test high school students for attention deficit disorder (ADD). There are three high schools in the district, each with grades 9-12. The school board pools all of the students together and randomly samples 250 students. Is this a simple random sample?

A) No, because the students could all come from the same school.
B) Yes, because each possible combination of 250 students is equally likely to be chosen.
C) No, because we cant guarantee that there are students from each school in the sample.
D) No, because we cant guarantee that there are students from each grade in the sample.

A) II only B) II and III C) I, II and III
D) I only E) III only

(d) In an intro stats class, 57% of students eat breakfast in the morning and 80% of students floss their teeth. Forty-six percent of students eat breakfast and floss their teeth. What is the probability that a student from this class eats breakfast but does not floss their teeth?

A) 9% B) 11% C) 34% D) 57%

(e) In an experiment the primary purpose of blinding is to reduce

A) bias. B) confounding.
C) randomness. D) variation.

(f) All but one of the statements below contain a mistake. Which one could be true?

A) There is a high correlation between cigarette smoking and gender.

B) The correlation between age and weight of a newborn baby is $r = 0.83$ ounces per day.

C) The correlation between blood alcohol level and reaction time is $r = 0.73$.

D) The correlation between a persons age and vision (20/20?) is $r = 1.04$.

(g) Which statement about bias is true?

I. Bias results from random variation and will always be present.
II. Bias results from samples that do not represent the population.
III. Bias is usually reduced when sample size is larger.

A) I only B) II only C) III only
D) I and III only E) I, II, and III

(h) Two sections of a class took the same quiz. Section A had 15 students who had a mean score of 80, and Section B had 20 students who had a mean score of 90. Overall, what was the mean score for all students on the quiz?

A) 84.3 B) 85.7 C) None of these D) It cannot be determined.

(i) What is it about chance outcomes being random that makes random selection seem fair?
I. Nobody can guess the outcome before it happens.
II. When we want things to be fair, usually some underlying set of outcomes will be equally likely.
III. Random outcomes display personal stakes in a particular outcome.

A) I and II B) II and III
C) I and III D) All are not true.

(j) Which of the following is not part of the 5-number summary:

A) The minimum and maximum B) The mean
C) The median D) The quartiles: Q_1 and Q_3

2. **[5 points]**To determine if people's preference in dogs had changed in the recent years, organizers of a local dog show asked people who attended the show to indicate which breed was their favorite. This information was compiled by dog breed and gender of the people who responded. The table summarizes the responses.

	Female	Male	Total
Yorkshire Terrier	73	59	**132**
Dachshund	49	47	**96**
Golden Retriever	58	33	**91**
Labrador	37	41	**78**
Dalmatian	45	28	**73**
Other breeds	86	67	**153**
Total	**348**	**275**	**623**

a) Identify the variables and tell whether each is categorical or quantitative.

b) Which of the W's are unknown for these data?

c) Find each percent.
i. What percent of the responses were from males who favor Labradors?
ii. What percent of the male responses favor Labradors?
iii. What percent of the people who choose Labradors were males?

d) What is the marginal relative frequency distribution of breeds?

e) What is the relative frequency distribution of breeds among the female respondents?

f) Do you think the breed selection is independent of gender? Justify.

(Question 2 $\cdots$)

3. [**5 points**] Assume that a normal model, with $\mu = 65.0$ inches and $\sigma = 3.5$ inches, can be used to describe the heights of adult females in North America.

   a. Find the percentage of adult females in North America that are under five feet (60 inches).

   b. Find the percentage of adult females in North America that are over six feet (72 inches).

   c. Find the percentage of adult females in North America that are between 60 and 70 inches.

   d. Find the 5th and 95th percentiles for this distribution.

(Question 3 $\cdots$)

4. **[5 points]** Consider the two events A and B with $P(A) = 0.5$ and $P(B) = 0.2$.

   (a) Compute $P(A \text{ or } B)$ if A and B are disjoint.

   (b) Compute $P(A \text{ or } B)$ if A and B are independent.

   (c) Compute $P(A|B)$ if A and B are disjoint.

   (d) Compute $P(A|B)$ if A and B are independent.

   (e) If $P(A \text{ and } B) = 0.02$ are A and B independent?

(Question 4 $\cdots$)

5. **[5 points]** The data values below represent the prices per share of the 10 most actively traded stocks from the New York Stock Exchange (rounded to the nearest dollar) on Oct. 1, 2003.

$$2, 4, 11, 12, 13, 15, 31, 32, 37, 47.$$

a) Sketch a stem-and-leaf plot.

b) Find the median, the first quartile, and the third quartile.

c) Sketch a box plot. What feature of the distribution displayed in the plot in (a) is not obvious in the box plot?

d) Suppose that we would like to randomly select 3 of these stocks. How many different combinations are there?

(Question 5 $\cdots$)

6. **[5 points]** Two researchers measured the pH of water collected from rain and snow over a 6-month period.

3.5	4.12	4.26	4.31	4.39	4.4	4.41	4.45	4.5
4.5	4.51	4.52	4.55	4.57	4.58	4.61	4.61	4.62
4.64	4.68	4.69	4.7	4.72				

(a) Describe their data with a graph and a few sentences.

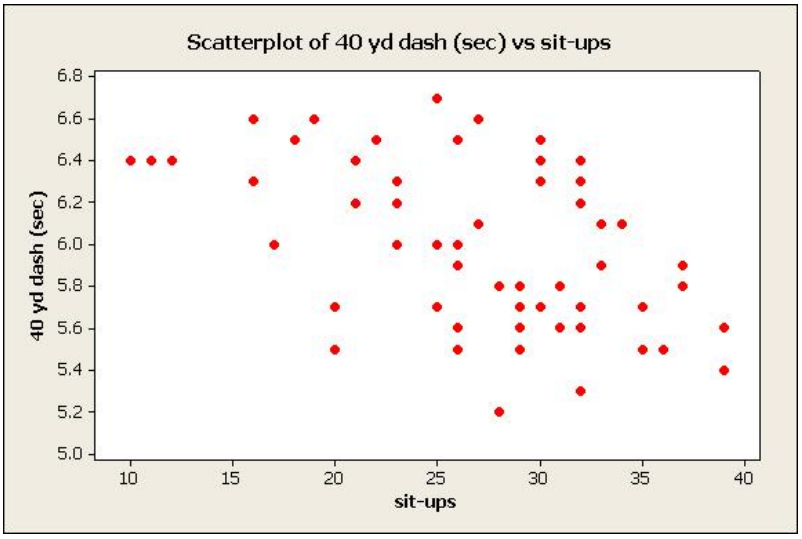
(b) Compute the mean and the standard deviation for these data. Note that

$$\sum x = 102.84 \quad \text{and} \quad \sum x^2 = 461.3102.$$

c) Using the appropriate measures, describe the central tendency and the dispersion of these data.

(Question 6 $\cdots$)

7. [**5 points**] We will study the relationship between how many sit-ups you can do and how fast you can run 40 yards. Below is a scatter plot for these variables for a study of female athletes.



a) Describe the association between these variables.

b) The least-squares line is $\widehat{y} = 6.74 - 0.0276\,x$. Find the predicted tim in the 40-yard dash for a subject who can do (i) 10 sit-ups, (ii) 40 sit-ups. Based on these, explain how to sketch the regression line over this scatterplot.

c) Interpret the y-intercept and slope of the equation in (b), in context.

d) Based on the slope in (a), is the correlation positive, or negative? Explain.

(Question 7 $\cdots$)

8. [**5 points**] A study identified nearly all cases in Sweden in 1999-2000 of acoustic neuroma, a benign tumor on the auditory nerve. It matched these subjects with others of similar age, gender, and residential area who did not have acoustic neuroma and compared the two groups on their mobile phone use. When considering tumors on the same side of the head as the phone was normally used, those with tumors were more likely to have used mobile phones for at least 10 years than those without tumors.

   a) Was this an experimental study or an observational study? Explain.

   b) Explain why this does not prove that greater use of mobile phones causes subjects to be more likely to develop acoustic neuroma.

(Question 8 $\cdots$)

9. [**5 points**] An amusement park has opened a new roller coaster. It is so popular that people are waiting for up to 3 hours for a 2-minute ride. Concerned about how patrons feel about this, they survey every 10th person on the line for the roller coaster, starting from a randomly selected individual.

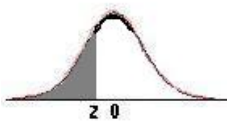
   a) What kind of sample is this?

   b) Is it likely to be representative?

   c) What is the sampling frame?

(Question 9 $\cdots$)

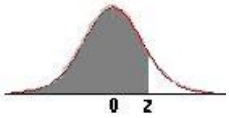
Table Z: Areas under the standard Normal curve



0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0	z
									0.0000	-3.9
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-3.8
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-3.7
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	-3.6
0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	-3.5
0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	-3.4
0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	-3.3
0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	-3.2
0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010	-3.1
0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013	-3.0
0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019	-2.9
0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026	-2.8
0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035	-2.7
0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047	-2.6
0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062	-2.5
0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082	-2.4
0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107	-2.3
0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139	-2.2
0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179	-2.1
0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228	-2.0
0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	-1.9
0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359	-1.8
0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446	-1.7
0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548	-1.6
0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668	-1.5
0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808	-1.4
0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968	-1.3
0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151	-1.2
0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357	-1.1
0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587	-1.0
0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841	-0.9
0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119	-0.8
0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.242	-0.7
0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743	-0.6
0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085	-0.5
0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446	-0.4
0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821	-0.3
0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207	-0.2
0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602	-0.1
0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000	-0.0

* For $z \leq -3.90$, the areas are 0.0000 to four decimal places.

Table Z (cont.) Areas under the standard Normal curve



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998
3.6	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.7	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.8	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.9	1.0000*									

* For $z \geq 3.90$, the areas are 1.0000 to four decimal places.