Math 150 Final Exam Fall 2014

City College of New York

Please print clearly

Last Name: *ANSWER KEY*

First Name:_____ **LAST 4 DIGITS OF ID#:**_____

1) Turn off cell phones and put them and all notes out of sight.
2) Calculators are permitted, but may not be passed between students. NO scrap paper (use sheets provided).
3) Points will be deducted if a solution is given without justification of your work.

SHOW ALL WORK

Answer 9 **complete** questions. Omit three complete questions. Each question is worth 11 points. There is one free point on the exam.

If you answer more than 9 questions, cross out all work not to be graded. Otherwise your lowest scoring questions will be the ones used towards your grade.

If not specified otherwise, give all measurements to two decimal places of accuracy.

Z-scores and percentiles for normal distributions, conversions, and formulas are on the last page.

1) a) Consider the following argument. Draw a carefully labeled diagram for each one to test the validity of each argument. State whether the argument is valid or invalid. (6 pt.)

Premise: If a mammal hibernates over the winter, then it has thick skin.
Premise: If a mammal doesn't have thick skin, then it has large claws.
Conclusion: If a mammal doesn't have large claws, then it doesn't hibernate over the winter.

b) If test scores are normally distributed with mean 74 and standard deviation 8, what are the z-scores for the following test scores: 66, 86, and 100? (5 pt.)

FALSE!

INVALID!

(b)

$$\frac{66-74}{8} = -1$$

$$\frac{86-74}{8} = 1.5$$

$$\frac{100-74}{8} = 3.25$$

2) a) Suppose a house is purchased at $175,000 and sold at $230,000. What is the percentage gain for the seller of the house? (6 pt.)

b) The heights of a sample of 14 people in a coffee shop (in inches) are as follows:

62, 68, 58, 74, 61, 66, 62, 70, 65, 72, 64, 57, 66, 67

Find the mean, median and the five-number summary and make a box plot. (5 pt.)

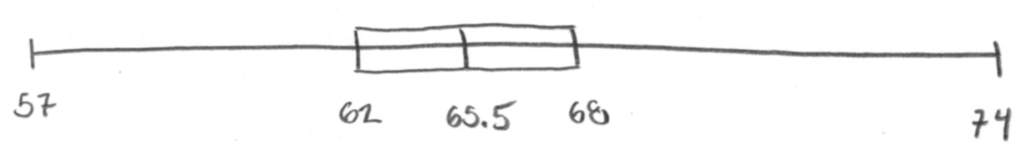
(a) $\frac{230,000 - 175,000}{175,000} = \frac{55,000}{175,000} = \frac{11}{35} = 0.3143$

$\sim$ **31.43%**

(b) MEAN $= \frac{912}{14} =$ **81**

MEDIAN : 57 58 61 62 62 64 65 66 66 67 68 70 72 74

LQ (62)   **65.5**   UQ (68)



3) a) If a rectangular room measures 12 feet by 9 feet, how much will it cost to carpet the room with carpeting that costs $18 per square yard. (Note: 3 feet = 1 yard.) (6 pt.)

b) The CPI in 1979 was 72.6. In 2013 it was 233.0. A candy bar that you buy today for $1 use to cost what amount in 1979? (You may assume that the price of candy bars can be estimated reasonably well using CPI.) Give your answer to the nearest cent. (5 pt.)

(a) $4\text{yd} \times 3\text{yd} = 12\text{yd}^2$

$$12\text{yd}^2 \times \frac{\$18}{1\text{yd}^2} = \boxed{\$216}$$

(b) $$1\ \$_{2013} \times \frac{72.6\ \$_{1979}}{233.0\ \$_{2013}} = \boxed{\$0.31}$$

4) At the beginning of each year, the residents of Snowville expect to have 6 inches of snow on the ground. Throughout the month of January, snowstorms are expected to add a quarter inch of snow every day.

a) Find a function that gives the expected amount of snow on the ground in Snowville t days into the new year. (5pt.)

b) After the 31 days of January have passed, how much snow is expected to be on the ground? (3 pt.)

c) If you want to visit Snowville before there is a foot of snow on the ground, when is it too late to go? (Note that $t = 0$ on January 1st.) (3 pt.)

(a) $s(t) = 6 + 0.25t$

(b) $s(31) = 6 + 0.25(31) =$ 13.75 INCHES

(c) $s(t) = 6 + 0.25t = 12$

$0.25t = 6$

$t = 24$

JAN 25TH

5) a) If the value of a car decreases by 11% each year, by what percentage does its value decrease in a 12- year period? (6 pt.)

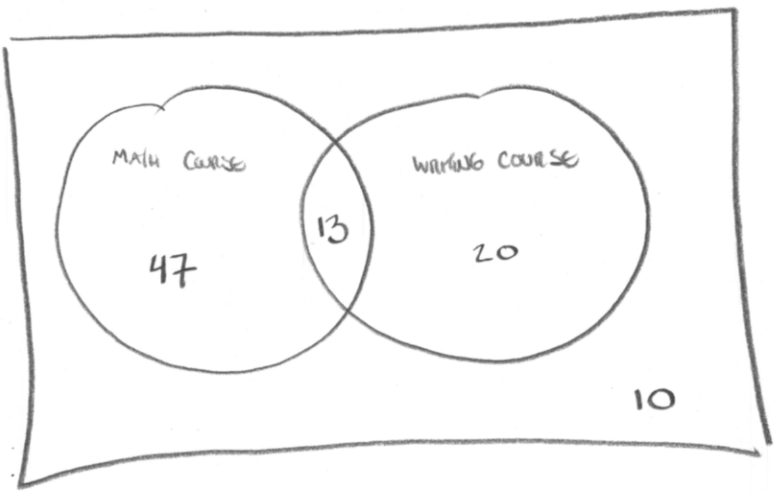
b) Draw a carefully labelled Venn diagram to represent the following data and answer to the following question:

In a survey of 90 first-year students, 60 were enrolled in a math course and 33 were enrolled in a writing course. Of those enrolled in the writing course, 20 weren't enrolled in a math course.

How many students in the survey were enrolled in neither a math course nor a writing course? (5 pt.)

(a) $(0.89)^{12} = 0.2470 \longrightarrow 1 - 0.2470 =$ DECREASES BY $\boxed{75.30\%}$

(b)



$\boxed{10}$

6) a) Suppose the bill at a restaurant comes to $25.76. If you leave an 18% tip, how much money (in total) do you pay the restaurant? Round off your answer to the nearest cent. (5 pt.)

b) When Mars and the Earth are closest together, they are 33.9 million miles apart. Using the fact that there are 5,280 feet in a mile, express this distance in feet. Give your answer in scientific notation correct to 2 decimal places. (6 pt.)

(a) $1.18 \times 25.76 =$ $\$30.40$

(b) 33.9 million miles $\cdot \dfrac{5{,}280 \text{ ft}}{1 \text{ mi}} =$ 178,992 million ft

i.e. 178,992,000,000 ft

1.79×10^{11} ft

7) a) Identify any potential source of bias in the following study if there are any. Explain your answers clearly.

To determine what percentage of Americans oppose gun control, a Fox News correspondent asks viewers to text their opinion to a number displayed on the TV screen. The results are tallied and then displayed during the show. (5 pt.)

b) If tuition increased by 35 % over the last decade, but decreased by 25 % during the next decade, what would the overall percentage change in tuition be for the two decades combined? (6 pt.)

(a) SELECTION BIAS: ONLY VIEWERS OF FOX NEWS ARE MADE AWARE OF THE SURVEY

PARTICIPATION BIAS: TEXTING ONE'S RESPONSE IS OPTIONAL, AND MOST LIKELY ONLY THOSE WITH STRONG OPINIONS WILL RESPOND.

(b)

$100 \times 1.35 = 1.35$

$1.35 \times .75 = 1.0125$

INCREASES 1.25 %

8) A factory in a town of 30,000 people shuts down causing people to migrate to a nearby city. Each year the town loses 3% of its population.

a) Find a function that gives the population of the town t years after the factory shuts down. (5pt.)

b) Using the rule of 70, estimate how long it will take before the population is half of its initial size of 30,000 people. (3 pt.)

c) How many people did the town lose 10 years after the factory shut down? (3 pt.)

(a) $Q(t) = 30{,}000 \times 0.97^{t}$

(b) $\frac{70}{3} \approx$ 23.33 YEARS

(c) $Q(t) = 30{,}000 \times 0.97^{10} = 22{,}122.7$

So $30{,}000 - 22{,}122.7 =$ 7,877

9) a) Suppose gas prices go all the way down to $2.00 per gallon and suppose your car averages 30 miles per gallon. How much would it cost you to drive 3,000 miles to California? (5 pt.)

b) If a 60-Watt light bulb is left on for an entire month, how many kilowatt-hours of energy are used?

(a) $3000 \text{ mi} \times \frac{1 \text{ g}}{30 \text{ mi}} \times \frac{2 \$}{1 \text{ g}} = \boxed{\$200}$

(b) $60 \text{ WATTS} \times 720 \text{ HRS} \times \frac{1 \text{ KW-HR}}{1{,}000 \text{ W-HR}} = \boxed{43.2 \text{ KW-H}}$

$24 \times 28 = 672$

$24 \times 30 = 720$

$\boxed{40.32}$

10) a) A company produces oil in vats which contain 1200 liters of liquid. The company wishes to fill bottles that hold 450 milliliter with the liquid. How many such bottles can be filled from 6 vats? Give a whole number (of bottles) as your answer. (6 pt.)

b) An amoeba cell is about 2.5×10^{-4} meters in length. If you were to line up 7 billion amoeba, end-to-end, what is the total length? You must convert all numbers to scientific notation, calculate the length and leave the final answer in scientific notation, correct to two decimal places. (5 pt.)

(a) $\dfrac{6 \times 1200\ L}{450\ mL} = \dfrac{7200\ L}{.450\ L} = \boxed{16,000}$

(b) $2.5 \times 10^{-4} \times 7 \times 10^{9} = 17.5 \times 10^{5}$

$= \boxed{1.75 \times 10^{6}\ m}$

11) A statistician surveys movie-goers to try and determine their favorite genre, limiting the choices to action, comedy, drama, and science fiction. The raw data from 15 results are as follows:

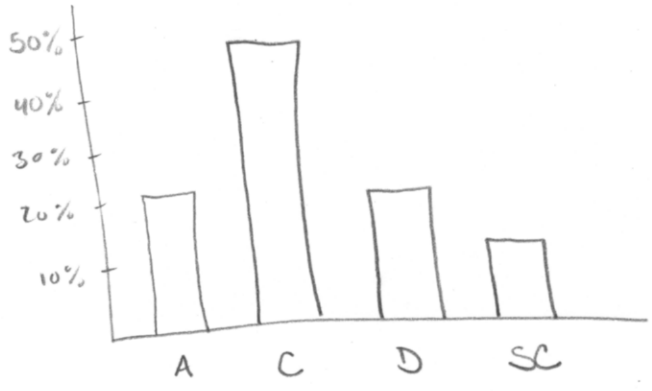
Science Fiction, Action, Comedy, Drama, Comedy, Comedy, Comedy, Action, Drama, Science Fiction, Comedy, Comedy, Action, Drama, Comedy

a) Construct a frequency table. Include a column for relative frequency. (5 pt.)
b) Draw a bar chart for the relative frequencies. (3 pt.)
c) What percentage of movie-goers did not give "Comedy" as an answer? (3 pt.)

(a)

CATEGORY	FREQUENCY	RELATIVE FREQUENCY
ACTION	3	20%
COMEDY	7	47%
DRAMA	3	20%
SCI FI	2	13%
TOTAL	15	100%

(b)



(c) 53%

12) Based on past data, the high temperature on January 1st in Columbus is approximately normally distributed with a mean of 38 degrees and a standard deviation of 12 degrees.

a) What percent of January 1st days had a high temperature of more than 50 degrees? (6 pt.)
b) What percent were between 26 and 50 degrees? (5 pt.)

(a) $z = \frac{50 - 38}{12} = 1 \longrightarrow 84.13 \longrightarrow \boxed{15.87\%}$

(b) $z = \frac{26 - 38}{12} = -1 \longrightarrow 15.87$

$84.13 - 15.87 = \boxed{68.26\%}$

Z-scores and percentiles for normal distributions:

z-score	percentile	z-score	percentile	z-score	percentile	z-score	percentile
-3.5	0.02	-1.00	15.87	0.00	50.00	1.1	86.43
-3	0.13	-0.95	17.11	0.05	51.99	1.2	88.49
-2.9	0.19	-0.90	18.41	0.10	53.98	1.3	90.32
-2.8	0.26	-0.85	19.77	0.15	55.96	1.4	91.92
-2.7	0.35	-0.80	21.19	0.20	57.93	1.5	93.32
-2.6	0.47	-0.75	22.66	0.25	59.87	1.6	94.52
-2.5	0.62	-0.70	24.20	0.30	61.79	1.7	95.54
-2.4	0.82	-0.65	25.78	0.35	63.68	1.8	96.41
-2.3	1.07	-0.60	27.43	0.40	65.54	1.9	97.13
-2.2	1.39	-0.55	29.12	0.45	67.36	2.0	97.72
-2.1	1.79	-0.50	30.85	0.50	69.15	2.1	98.21
-2.0	2.28	-0.45	32.64	0.55	70.88	2.2	98.61
-1.9	2.87	-0.40	34.46	0.60	72.57	2.3	98.93
-1.8	3.59	-0.35	36.32	0.65	74.22	2.4	99.18
-1.7	4.46	-0.30	38.21	0.70	75.80	2.5	99.38
-1.6	5.48	-0.25	40.13	0.75	77.34	2.6	99.53
-1.5	6.68	-0.20	42.07	0.80	78.81	2.7	99.65
-1.4	8.08	-0.15	44.04	0.85	80.23	2.8	99.74
-1.3	9.68	-0.10	46.02	0.90	81.59	2.9	99.81
-1.2	11.51	-0.05	48.01	0.95	82.89	3.0	99.87
-1.1	13.57	0.00	50.00	1.00	84.13	3.5	99.98

$$T_{Double} \approx \frac{70}{P} \qquad T_{Half} \approx \frac{70}{P}$$

$$Q = Q_0 \cdot 2^{\frac{t}{T_{Double}}} \qquad Q = Q_0 \cdot 2^{\frac{t}{T_{Half}}}$$

$$z = \frac{x - \bar{x}}{s}$$