

City College Department of Mathematics Fall 2019  
**MATH 150 Final Exam**

Last Name: \* Answer Key \* First Name: \_\_\_\_\_

Course Section: \_\_\_\_\_ Signature: \_\_\_\_\_

**SHOW ALL WORK**

- ◆ **You must answer 11 complete questions.**
- ◆ If you answer more than 11 questions, cross out all work not to be graded and write "OMIT" on the page of that question.
- ◆ If you answer more than 11 questions and fail to cross out the ones not to be graded, then only the *first eleven* will be graded.
- ◆ If not otherwise specified, give all numerical answers to two decimal places.
- ◆ Each problem is worth 9 points. You get 1 bonus point.
- ◆ *z*-scores and percentiles for normal distributions and formulas are on the last page of the exam.
- ◆ Turn off ALL electronic devices and put them and all notes out of sight.
- ◆ Scientific calculators ONLY! And may not be shared with other students.
- ◆ Points will be deducted if a problem is solved without written proof of your work.

**DO NOT WRITE ON BOXES**

Question	Points	Question	Points	Question	Points	Question	Points
1)		5)		9)		13)	
2)		6)		10)		14)	
3)		7)		11)			
4)		8)		12)			

<b>GRADE</b>	
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1. a) Alice invested \$40,000 into a money-market account that earns 3.2% interest annually. If she invested it this year (2019), and left it alone to grow in value, how much would it be worth in the year 2050 (at about the same time of the year)? Round your answer to the nearest *whole dollar*.
- b) Given that the CPI in 2004 was 188.9 and the CPI in 2005 was 195.3, find the *relative change* in the CPI (*inflation rate*) from 2004 to 2005. Round the percentage value to the nearest *tenths*.

$$(a) \quad 40,000 (1.032)^{31} \approx \boxed{\$ 106,201}$$

$$(b) \quad \frac{195.3 - 188.9}{188.9} \times 100\% \approx \boxed{3.4\%}$$

**DO NOT WRITE ON BOXES**

Question	Points	Question	Points	Question	Points	Question	Points
1)		9)		2)			
2)		10)		6)			
3)		11)		7)			
4)		12)		8)			

GRADE

2. a) The leasing rate for an office space in a building in Metropolis is \$125 per *square foot*. How much would it cost a start-up company to lease the space that has an area of 150 *square yards*? Round the answer to the nearest *whole dollar*. Use **1 yard = 3 feet**.

b) Explain the *placebo effect*.

(a)  $1 \text{ yd} = 3 \text{ ft}$

$1 \text{ yd}^2 = 9 \text{ ft}^2$

$$150 \text{ yd}^2 \cdot \frac{9 \text{ ft}^2}{1 \text{ yd}^2} \cdot \frac{\$125}{1 \text{ ft}^2} \approx \boxed{\$168,750}$$

(b) THE PHENOMENON THAT THE BELIEF THAT ONE IS RECEIVING TREATMENT CAN CAUSE OBSERVABLE CHANGES.

3. a) Suppose that running on a treadmill for 15 minutes burns 75 Calories of energy. Find the average power in *Joules per second*. Use **1 Calorie = 4,184 Joules**.

b) Write the negation of the following statement in a clear English statement. You may not start the sentence with "It is not the case that..." The statement is: **Some dogs don't eat pizza.**

$$(a) \quad 75 \text{ CAL} \cdot \frac{4,184 \text{ J}}{1 \text{ CAL}} = 313,800 \text{ J}$$

$$15 \text{ MIN} \cdot \frac{60 \text{ SEC}}{1 \text{ MIN}} = 900 \text{ SEC}$$

$$\frac{75 \text{ CAL}}{15 \text{ MIN}} = \frac{313,800 \text{ J}}{900 \text{ SEC}} = 348.67 \text{ J/S}$$

(5 CAL/MIN)

(b)

All DOGS EAT PIZZA.

(No DOGS DONT EAT PIZZA.)



4. a) KayMart has a tablet with a sale price of \$365.49. If this sale price includes a 15% discount, find the original retail price. Round your answer to the nearest cent.

b) A new life form found in the basement of Cohen Library was observed to double in number every 20 minutes. If the original amount observed was 45 life forms at noon, find the number of these life forms at 5 p.m. that same day.

$$(a) .85 P = 365.49$$

$$P = \frac{365.49}{.85} \approx$$

$$\boxed{\$ 429.99}$$

$$(b) y = A \cdot 2^{x/T_2} = 45 \cdot 2^{x/20}$$

Note:  $x$  is measured in MINUTES.

5PM is  $5 \cdot 60 = 300$  MIN AFTER NOON

$$45 \cdot 2^{\frac{300}{20}} = 45 \cdot 2^{15}$$

$$= \boxed{1,474,560}$$

5. a) Suppose that Homer weighed 150 pounds in September. One month later, he gained 10% in weight. Then in November, he lost 5% of his weight due to dieting. Find the overall percentage gain or loss in Homer's weight over the 2 month period. Show your calculations and round your percentage answer to the nearest tenth.

b) In what way might the following study be flawed?

*In a study designed to determine whether bicyclists who wear helmets have fewer accidents, researchers tracked 500 riders with helmets for one month.*

$$(a) \quad 150 \xrightarrow[\times 1.10]{+10\%} 165 \xrightarrow[\times .95]{-5\%} 156.75$$

$$\frac{156.75 - 150}{150} \times 100\% \approx \boxed{4.5\% \text{ GAIN}}$$

$$\left( = (1.10)(.95) \right)$$

(b.) FEWER ACCIDENTS ... THAN WHO?

SHOULDN'T THEY ALSO TRACK BICYCLISTS THAT

DO NOT WEAR HELMETS ? i.e. CONTROL GROUP.

ONE MONTH IS NOT THAT LONG,

MANY CYCLISTS GO YEARS WITHOUT ACCIDENTS.

6. a) Given the data set which represents the ages, in years, of 13 people, find the *mean*, *median*, *mode*, and any *outlier(s)*:

18, 21, 19, 17, 19, 21, 55, 23, 17, 19, 19, 22, 20

17 17 18 19 19 19 19 20 21 21 22 23 55

- b) The CPI (Consumer Price Index with base year in 1982-84) for 1995 was 152.4, while in 2005, it was 195.3. If Hodor's monthly rent in 1995 was \$1,100, find the equivalent rent in 2005. Round your answer to the nearest *whole dollar*.

(a) MEAN =  $\frac{290}{13} = 22.3077$

MED = 19

MODE = 19

OUTLIER = 55

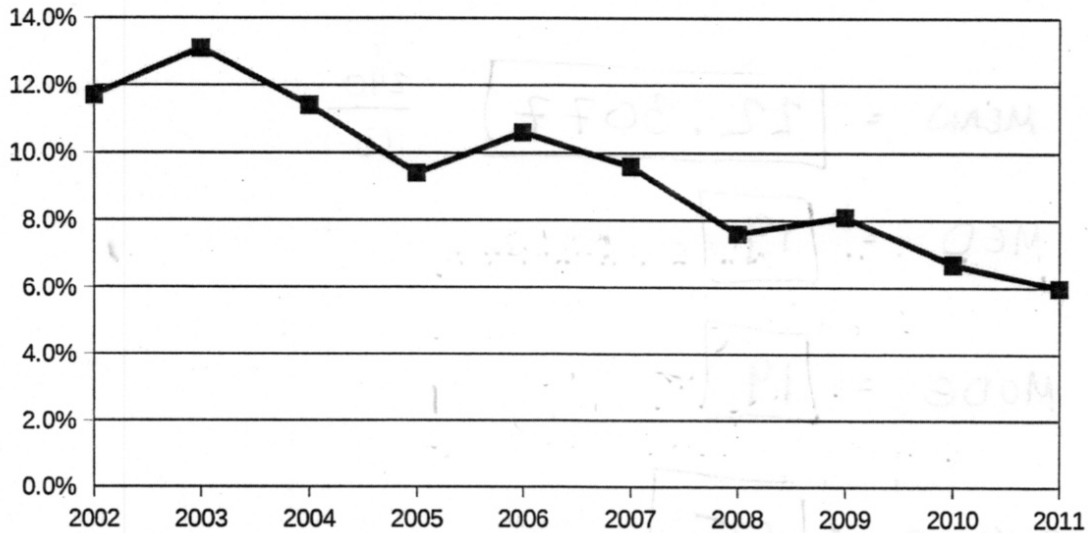
(b)  $1,100 \text{ \$}_{1995} \cdot \frac{195.3 \text{ \$}_{2005}}{152.4 \text{ \$}_{1995}}$

=  $\$1409.65 \rightarrow \$1410$

7. a) For a statistical study to rate the lunch quality in the school cafeteria, 5 students are selected from each classroom. Identify the *sampling method*.

b) The graph below shows Brazil's unemployment rate for the years 2002 to 2011. For credit, you must show the numbers that you used for your calculations in each part of the problem.

Brazil's unemployment rate (2002-2011) in percent



(i) Find the *absolute change* (in percentage points) and *relative change* in the unemployment rate from 2003 to 2004. Express the relative change to the nearest *tenth*.

(ii) If there were 104.3 million people in the labor force in 2011, how many were unemployed?

(a)

STRATIFIED SAMPLE

(b)

From 13% in 2003 to 11.5% in 2004 → -1.5% ABSOLUTE

$$\frac{11.5 - 13}{13} \times 100\% = -11.5\% \text{ RELATIVE}$$

$$6\% \text{ OF } 104.3 \text{ MILLION} = .06 \times 104,300,000$$

$$= 6,258,000$$

OR 6.258 MILLION

8. a) Draw a Venn diagram that accurately reflects the relationship among the statements in the argument below. Make no additional assumptions. Be sure to include a universe (you may create one) and label all sets accurately. Then analyze the diagram for validity and state whether it is "valid" or "invalid."

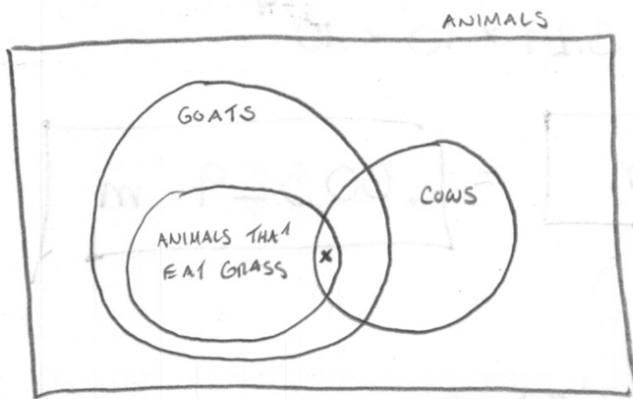
**Premise: If an animal eats grass, then the animal is a goat.**

**Premise: Some cows eat grass.**

**Conclusion: Some cows are goats.**

- b) In one recent survey, it was found that 65% of Americans watched the Academy Awards, with a margin of error of 3 percentage points. Construct a *confidence interval* from the survey results.

(a)



VALID

(b)

$$65\% - 3\% \quad \text{to} \quad 65\% + 3\%$$

62% to 68%

$$\leftrightarrow [0.62, 0.68]$$

9. a) The diameter of an atom of a crystal is  $4.7 \times 10^{-13}$  meters. If a crystal has 7 billion atoms lined up next to each other, how long is that crystal? You must convert all numbers to scientific notation, calculate your answer in scientific notation and then convert back to decimal.

b) The current global population is estimated to be 7.62 billion people, out of which, about 1.31 billion is from the nation of India. Find the percentage of the global population who are not from India. Express your answer to the nearest tenth.

$$(a) \quad (4.7 \times 10^{-13}) (7 \times 10^9) = (4.7 \times 7) (10^{-13} \times 10^9)$$

$$= 32.9 \times 10^{-4} = 3.29 \times 10^1 \times 10^{-4}$$

$$= \boxed{3.29 \times 10^{-3} \text{ m}} = \boxed{.00329 \text{ m}}$$

$$(b) \quad \frac{7.62 - 1.31}{7.62} = \frac{6.31}{7.62} = .8281$$

$$\rightarrow \boxed{82.8\%}$$

10. a) In an experimental study, describe the difference between the *experimental group* and the *control group*.

b) Prior to re-centering in 1995, the mean SAT verbal score was about 430 points. Assume that the SAT verbal scores are normally distributed with a standard deviation of 100 points.

(i) What percentage of the SAT verbal scores were over 370 points?

(ii) Explain how you would find the percentage of scores that go over 430 points without doing any calculations.

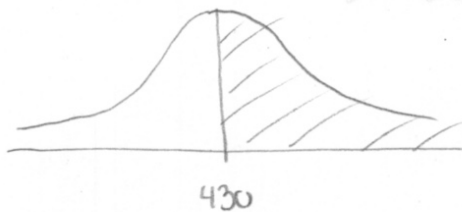
(a) EXPERIMENTAL GROUP RECEIVES TREATMENT.  
CONTROL GROUP DOES NOT.

(b) (i)  $P(X \geq 370) = 1 - P\left(Z \leq \frac{370 - 430}{100}\right)$

$= 1 - P(Z \leq -0.6)$

$= 1 - .2743 = 72.57\%$

(ii) Normal distribution is symmetric  
About mean = 430



50%

28F



11. a) In an experiment to study the effects of a drug on reaction time, a subject is asked to depress a button whenever a light flashes. The reaction times (in seconds) for 10 trials are:

10.1 9.6 10.3 13.7 9.4 9.9 9.8 10.4 9.7 7.8

Find the five-number summary for this data set and draw a properly labeled boxplot with a labeled axis.

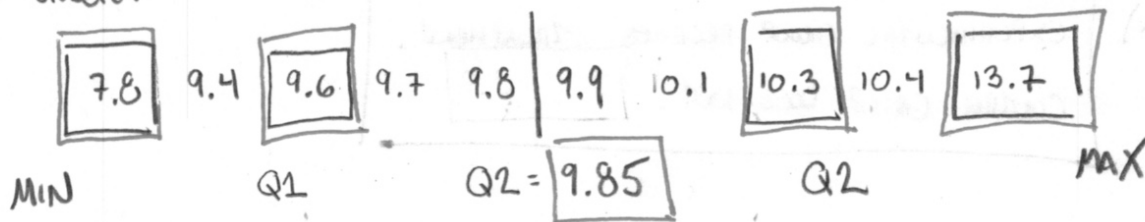
- b) The cost of creating and printing a color pamphlet is \$115 setup fee and plus 35 cents for each copy.

(i) Write an equation that relates the cost of the job,  $C$ , to the number of copies made,  $n$ .

(ii) Using the equation in (i), how many copies can you make for \$390?

(a)

in order:



(b)

(i)  $C = 115 + .35n$

(ii)  $390 = 115 + .35n$

$275 = .35n$

$n = \frac{275}{.35} = 785.7$  (CANNOT AFFORD 786 COPIES.)

$\Rightarrow$  785

12. a) On a map, 3 kilometers are represented by 5 centimeters. Find the scale ratio for this map. You must specify which number belongs to which distance: map distance and actual distance. Use 1 meter = 100 centimeters and 1 kilometer = 1000 meters.

$$(a) \quad 3 \text{ km} \cdot \frac{1000 \text{ m}}{1 \text{ km}} \cdot \frac{100 \text{ cm}}{1 \text{ m}} = 300,000 \text{ cm}$$

ACTUAL DISTANCE : MAP DISTANCE

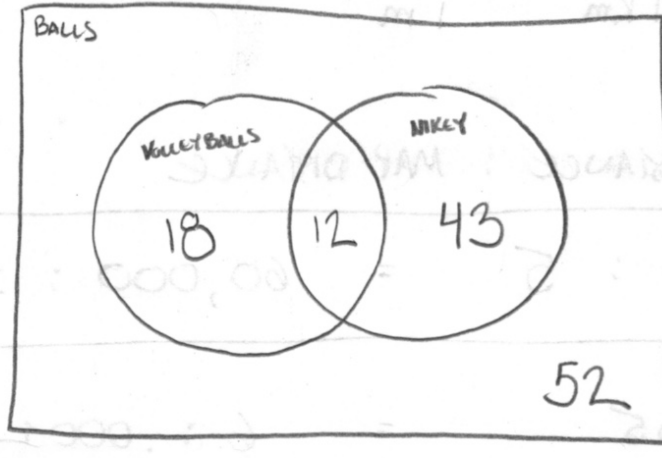
$$300,000 : 5 = 60,000 : 1$$

$$3 : .00005 = 6 : .0001$$

$$(b) \quad \frac{70}{4.2} \approx 16.7 \text{ HRS}$$

13. a) In the school gym locker, there are a total of 125 balls in storage, out of which 30 are volleyballs. Of the 30 volleyballs, 12 are made Nikey. There are a total of 55 balls made by Nikey. Draw a 2-set Venn diagram that represents the given information, with properly labeled sets and a universe. Then state the number of balls not used for volleyball that are not made by Nikey.

(a)

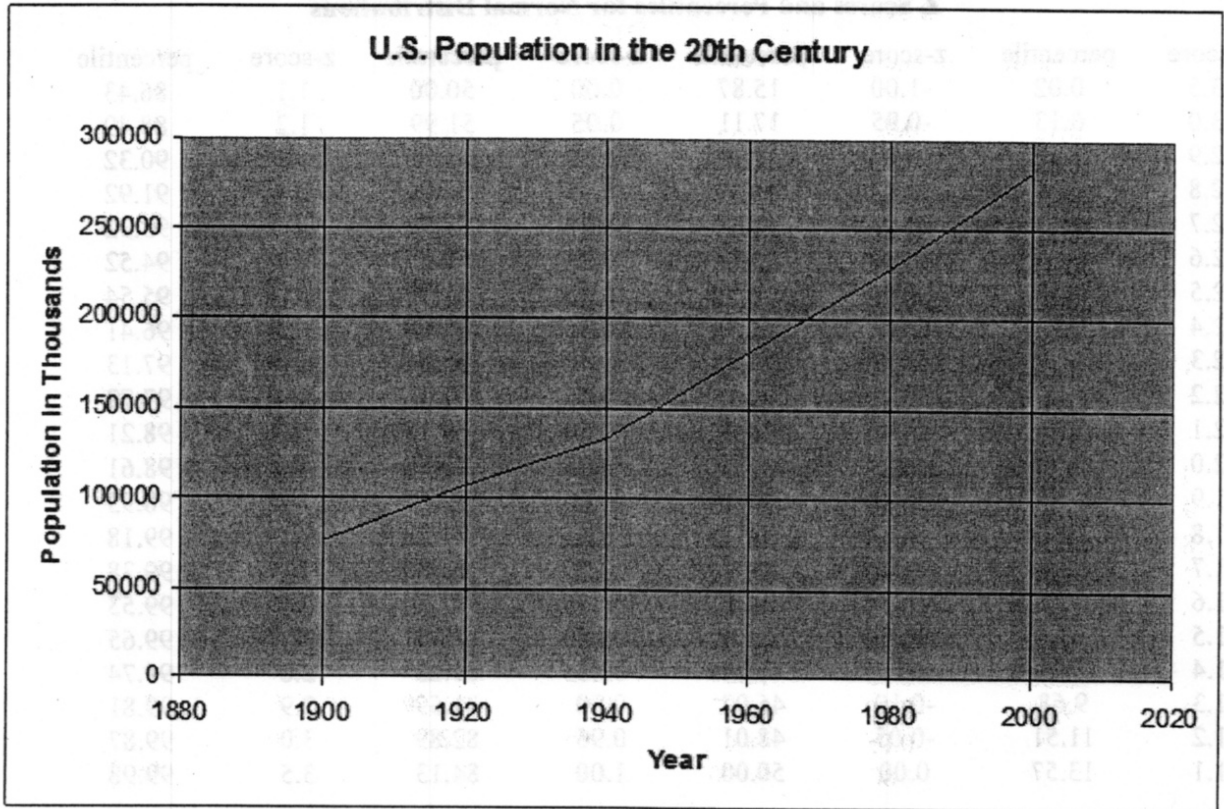


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(b)

$$1 \text{ LEU} \cdot \frac{.2338 \text{ \$}}{1 \text{ LEU}} \cdot \frac{70.51 \text{ RUPEES}}{1 \text{ \$}} = 16.49 \text{ RUPEES}$$

14.



a) Using the graph above, approximate the U.S. population in 1930. Write your answer as a number without using any words in your answer.

b) It is claimed that “the U.S. population almost tripled between 1900 and 1980.” Is this claim supported by the data in the graph? Give a calculation that supports or does not support this claim.

(a)  $\approx$  120,000,000

(b) FROM 80,000,000 TO 230,000,000

$$\frac{230,000,000}{80,000,000} \approx 3, \text{ YES}$$

END - Good Luck!!!

**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	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

$$T_{Double} \approx \frac{70}{P} \quad (P < 15)$$

$$T_{Half} \approx \frac{70}{P} \quad (P < 15)$$

$$Q = Q_0 \times (2)^{\frac{t}{T_{Double}}}$$

$$Q = Q_0 \times \left(\frac{1}{2}\right)^{\frac{t}{T_{Half}}}$$

$$Q = Q_0 \times (1 + r)^t$$

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