MATH 1681.100 PRACTICE FINAL

(1) Find the average of the numbers $\{1, 2, 3, 4, 10, 9, 8, 20\}$.
(2) Find the median of the numbers $\{1, 2, 3, 4, 10, 9, 8, 20\}$.
(3) Find the standard deviation of the numbers $\{1, 2, 3, 4, 10, 9, 8, 20\}$.
(4) You asked 10 people to flip a coin 5 times and record the number of "head"s. Here are the results:

Person 1	2 heads	Person 6	4 heads
Person 2	3 heads	Person 7	1 head
Person 3	5 heads	Person 8	3 heads
Person 4	0 heads	Person 9	2 heads
Person 5	2 heads	Person 10	3 heads.

Make a table for the distribution of percentages and sketch a histogram.
(5) You asked 10 people how many hours of sleep they got last night. Here are the results:

Person 1	7 hours	Person 6	5 hours
Person 2	7.5 hours	Person 7	6 hours
Person 3	10 hours	Person 8	8 hours
Person 4	8.5 hours	Person 9	4 hours
Person 5	9 hours	Person 10	7.5 hours.

Using the class intervals $[0, 5)$, $[5, 7)$, $[7, 9)$, $[9, 12)$, make a table for the distribution of percentages and sketch a histogram.
(6) Describe some basic characteristics of a normal distribution, in terms of its density graph (i.e. histogram).
(7) (T/F) If the average of one set of numbers is greater than the average of another set of numbers, then the standard deviation of the first set must also be greater than the standard deviation of the second set.
(8) The standard deviation measures what qualitative feature of a set of numbers?
(9) A normal distribution with a large standard deviation will have a [wider, thinner, impossible to tell] peak, compared to a normal distribution with a small standard deviation.
(10) A histogram represents percentages by [height of the graph, area under the graph, neither].
(11) Sketch an oval scatterplot for two variables x and y with the 5 statistic summary $A_x = 5$, $SD_x = 2$, $A_y = 10$, $SD_y = 3$, $r = 0.6$. In your sketch, include the SD line with its slope and the point of averages clearly labeled/shown.

(12) Here are predicted high temperatures (x) and low temperatures (y), in degrees Farenheit, for five days:

x ($°F$)	y ($°F$)
85	60
86	64
82	60
82	58
81	57

First calculate the 5 statistic summary for this data, by hand. Then calculate the 5 statistic summary for the same temperatures written in degrees Celcius, using the fact that degrees Celcius is a change of scale from degrees Farenheit given by the formula $°C = \left(\frac{5}{9}\right)(°F) - \frac{160}{9}$.

(13) For the Farenheit temperatures in the previous problem write the regression for the day's high temperature (x) on the low temperature (y). Then use it to predict the high temperature on a day where the low temperature was 55 degrees Farenheit.

(14) Using the same data and the normal approximation for the "horizontal strip" of days where the low temperature was 60 degreees Farenheit, predict the percentage of days where the low temperature was 60 degrees Farenheit and the high temperature was greater than or equal to 85 degrees Farenheit. (NOTE- this is just for practice - in real life we shouldn't trust the normal approximation with only 5 measurements!)

(15) Using the same data predict the overall percentage of days where the high temperature was greater than or equal to 85 degrees Farenheit.

(16) In a probabilistic sense, events A and B being independent means ???

(17) In a probabilistic sense, events A and B being disjoint (i.e. mutually exclusive) means ???

(18) Show that disjoint events cannot be independent, and vice versa.

(19) State the "addition rule" for probabilities.

(20) State the multiplication rule for probabilities of independent events.

(21) State the "law of complements" for the probability that a given event does not happen.

(22) (T/F) In drawing a single playing card from a well shuffled deck of 52, P(heart face card)=P(heart card)+P(face card).

(23) (T/F) In drawing a single playing card from a well shuffled deck of 52, P(heart card or face card)=P(heart card)+P(face card).

(24) (T/F) In drawing a single playing card from a well shuffled deck of 52, P(heart face card)=P(heart card)*P(face card).

(25) (T/F) In drawing a single playing card from a well shuffled deck of 52, P(heart card or diamond card)=P(heart card)+P(diamond card).

(26) (T/F) In rolling a pair of fair 6-sided dice, P(total being a multipe of 2 or a multiple of 3)= P(total being a multiple of 2)+P(total being a multiple of 3).

(27) (T/F) In drawing a single playing card from a well shuffled deck of 52, P(four of diamonds)=P(four of any suit)*P(diamond card).

(28) (T/F) In rolling a pair of fair 6-sided dice, P(total being 2 or 3)=P(total being 2)+P(total being 3).

(29) (T/F) In rolling a pair of fair 6-sided dice, P(4 spots on the first die and 6 spots on the second)= P(4 spots on the first die)*P(6 spots on the second).
(30) Calculate the exact probability of flipping 18 heads on 20 flips of a fair coin.
(31) Calculate the probability of rolling a total of 7 on a pair of fair 6-sided dice.
(32) Calculate the probability of rolling a total of 7 three times in 10 rolls of a pair of fair 6-sided dice.
(33) Calculate the average and standard deviation for a box model which has the values $x_1 = 5,\ x_2 = 1,\ x_3 = -5$ with probabilitites $p_1 = 0.3,\ p_2 = 0.2,\ p_3 = 0.5$, respectively. (Note - the average of a box is the expected value after one draw, the standard deviation is the standard error for one draw.)
(34) Now calculate the expected value and standard error for the sum of 100 draws (with replacement) from the box in the previous problem.
(35) Now calculate the expected value and standard error for the average of 100 draws (with replacement) from the box in the previous problem.
(36) Calculate the average and standard deviation for a box model which has the values $x_1 = 0,\ x_2 = 1$ with probabilities $p_1 = 0.3,\ p_2 = 0.7$, respectively.
(37) Now calculate the expected value and standard error for the number of 1s in 100 draws (with replacement) from the box in the previous problem.
(38) Now calculate the expected value and standard error for the percentage of 1s in 100 draws (with replacement) from the box in the previous problem.
(39) A box has 20 tickets of which 3 are marked with a 0 and the rest with 1s. If you sample 10 tickets without replacement, find the expected value and standard error for the number of 1s drawn. List three issues which make this experiment a bad place for using the normal approximation to construct confidence intervals.
(40) A box has 2,000 tickets. You sample 100 without replacement and find 61 of them to be marked with a 1 and the rest with 0s. Using the “bootstrap” assumptions, calculate the 68%, 95%, and 99% confidence intervals for (a) the number of 1s in the box and (b) the percentage of 1s in the box.
(41) A coin is flipped 100 times and lands 60 times on tails. If the null hypothesis is that the coin is fair and the alternative hypothesis is that the coin is biased towards tails, find the percentage of 100-flip trials in which this extreme of a result should have happened, under the assumption that the null hypothesis is correct. (People also call this the probability that such an extreme result should occur, given the null hypothesis.) By the standing convention, is this “statistically significant” evidence to reject the null hypothesis? What would you say if you had to guess if the coin is fair or not?
(42) Repeat the previous question, but this time let the alternative hypothesis be that the coin is biased in either direction (instead of assuming, as we did in the previous problem, that it’s either fair or biased towards tails.)