

Name:

MTH113 Final review

The MTH113 test is comprehensive. Some sample questions for you to practice on. Good luck.

For all the significance tests assume the level of significance is  $\alpha = 0.05$ .

1. A researcher investigates if there is a relationship between age and maximum heart rate, as purported by his health club. He finds 5 people to participate and records this data

Age	20	30	40	50	60
Maximum Heart Rate	202	185	178	170	165

- (a) Make a scatterplot with Age on the  $x$ -axis. Estimate the value of  $r$  from your scatterplot (positive? negative? Close to 1, 0 or -1?)
  - (b) Find  $\bar{x}$  (the average age) and  $\bar{y}$ .
  - (c) Compute  $r$  the correlation coefficient?
  - (d) What percent of total variation in the heart rate measurements can be attributed to the linear relationship between age and maximum heart rate?
  - (e) Find the equation of the regression line
$$\hat{y} = b_0 + b_1x$$
  - (f) A common health-club fact is that MHR is 220 minus the age. Does this seem appropriate given the data?
  - (g) Use the regression line to predict the maximum heart rate of a 25 year old. An 18 year old.
2. The FDA is testing a new cold drug to see if it is better than the currently approved one. For the currently approved one 75% of the population finds it useful. In a test of the new drug of 1000 patients, 770 found the new drug useful. Is this statistically significant evidence that the new drug is better than the old? Use  $\alpha = 0.05$ .
  3. A species of turtle lays many eggs of which historically 5% would survive through childhood. A researcher is investigating if this success rate has gone down. She tracks 250 turtle eggs and sees that only 8 survive. Has she found statistically significant evidence that the survival rate has gone down? Use  $\alpha = 0.05$ .
  4. Draw a boxplot by hand of data with summary

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
6	315	684	933	1320	4940

5. For the data set

55 4 34 26 31 12 21 44 30 6 13

with mean 25.09 and standard deviation 15.92 find the percentile rank of 21 and its  $z$  score.

6. List all possible outcomes of tossing a coin 4 times. Circle the times where the number of heads is 3 and find the probability of that assuming equally likely events.
7. If there are 30 M&M's in a bag: 10 red, 5 blue, 5 brown and 10 green. What is the probability of picking one at random and having it be green or blue?
8. How many license plates of the form 3 letters then 3 numbers if we assume that there are no Q's for letters and no 0's for numbers.
9. A new car can have stick or automatic; be in red, blue or yellow, and have a sun roof or not. What are all the possible different cars (write them all down using some abbreviations).
10. Simplify as much as possible leaving a fraction written in terms of factors. For example  $4!/2! = 4 \cdot 3$ . ( $n$  is an unknown.)

$${}_5P_3 \quad \binom{8}{4} \quad \binom{50}{4} \quad \binom{n}{2}.$$

11. A class of 8 students arrives 1 by 1. How many different orders are there for them to arrive?
12. A team of 12 players must select a captain and co-captain. How many possibilities are there?
13. A team of 12 players must select 5 players to start a game. How many possibilities are there.
14. After years of being a waitress it is decided that the chance a person leaves a tip of a certain percent has this probability

percent	5	10	15	20
	.25	.25	.40	.10

Find the expected tip percentage.

15. Let  $X$  be normal with mean 60 and standard deviation 10. Find these **without** using a table
  - (a)  $P(50 \leq X \leq 70)$
  - (b)  $P(X < 80)$
  - (c)  $P(X > 70)$ .
16. Let  $X$  be normal with mean 60 and standard deviation 10. Find these using a table
  - (a)  $P(55 < X)$
  - (b)  $P(X < 45)$
17. If  $X$  is normal with mean 100 and variance 25, find the 25th percentile of  $X$ . That is find  $x$  so that  $P(X < x) = 0.25$ .
18. Assume the adult black bear has a normally distributed weight with mean 400 and standard deviation 25. Find the probability that a randomly chosen adult black bear is 375 or more pounds.
19. Toss a coin 400 times. Use the normal approximation to the binomial to find the probability that your get 175 or fewer heads.
20. You have store front which has 10,000 people drive by everyday. If the probability that a random person driving by will stop by is 1 in 1000, use the normal approximation to find the probability of 12 or more customers in a day.
21. A 1000 people are surveyed to see if they will drive less this summer, as gas prices are so stinkin high. From the 1000, 325 said yes. Use this to find a 95% confidence interval for the proportion of all people who will drive less this summer, assuming a random sample.
22. A poll of 2003 poll of 2018 Canadians found that 1070 supported gay marriage. Do a test of significance to see if this indicates that the true percentage for Canadians is more than 50%.

23. A 2003 European opinion poll of George Bush found only 16 percent of 200 people supported George Bush. Does this indicate that the population proportion of those who support George Bush is different than the 0.28 proportion in the US (as reported by Newsweek)?
24. Last month the average time to park on campus was 8 minutes. This month (as more students have dropped out) it seems to take less time. Suppose, the sample average for 10 trips is 7 minutes with a sample standard deviation of 2 minutes. Does this indicate that the average time is less or is the difference explainable by sampling variation?
25. A test to determine if echinacea is beneficial in treating the common cold was setup as follows. If a child reported cold symptoms then they were randomly assigned to be given a treatment of echinacea or a placebo treatment. The time to recover was measured and is summarized in the table below

group	n	sample mean	sample sd
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echinacea	20	5.0	2.5
placebo	17	5.4	2.5

Is this evidence that the echinacea group had a quicker recovery? Assume the population standard deviations are the same. Redo the problem without assuming that the population standard deviations are the same.

26. Is the line at the DMV improved? Historically, it took 65 minutes to do something at the DMV. After changes were made a sample of 21 people found their time was only 59 minutes. Is this evidence that the mean time has decreased?