

Practice Exam 1
(Answers are found on the last page.)

Name: _____

Instructions:

1. Do not start until instructed to do so.
2. You may use a scientific calculator (no graphing calculators allowed).
3. No other aids are allowed.
4. The work you turn in must be your own.
5. Use $\alpha = .05$, unless otherwise specified.
6. **SHOW ALL WORK** to receive full credit.

Questions 1-2: The Vice President for Nursing Services at St. Luke's Memorial Hospital recently noticed that unionized jobs for nurses seem to offer higher wages. She decided to investigate and gathered the following information on two random samples of nurses.

Group	Mean Wage	Standard Deviation	Sample Size
Union	\$20.75	\$2.25	40
Nonunion	\$19.80	\$1.90	45

1. **5 points** The p-value for the test of

$$H_0: \mu_{Union} = \mu_{Nonunion}$$

$$H_a: \mu_{Union} > \mu_{Nonunion}$$

is .0183. What does this number mean in the context of the problem?

2. **2 points** Which test was used?

- Independent samples t-test
- Independent samples z-test
- Paired samples t-test
- Paired samples z-test
- Independent samples F-test

Questions 3-4: The amount spent on housing is an important component of the cost of living. The total costs of housing for homeowners might include mortgage payments, property taxes, and utility costs (water, heat, electricity). An economist selected a random sample of 20 homeowners in New England and calculated these total housing costs as a percent of monthly income at two times: five years ago and now. Minitab output is given below. Assume that the percentages five years ago, now, and the difference (five years ago – now) are normally distributed.

	N	Mean	StDev
Five Years Ago	20	33.15	11.08
Now	20	26.85	10.38
Difference	20	6.30	12.48

3. **10 points** Is it reasonable to conclude that the average percent of monthly income needed for housing for all New England homeowners five years ago was greater than now? Show your hypotheses, the value of the test statistic, the rejection region, p-value, and give the conclusion in terms of the problem.

4. **5 points** Find a 95% confidence interval for the difference $\mu_{FiveYearsAgo} - \mu_{Now}$. Does the confidence interval agree with the result of the hypothesis test? Explain.

5. **10 points** Each month the National Association of Purchasing Managers publishes the NAPM index. One of the questions asked on the survey to random samples of purchasing agents is: Do you think the economy is expanding? Last month, of the 300 responses, 160 answered yes to the question. This month, 170 of the 290 responses indicated they felt the economy was expanding. Can we conclude that a larger proportion of all agents believe the economy is expanding this month? Use either a hypothesis test or a confidence interval to answer the question. You may just answer “yes” or “no.”

Questions 6-7: A study is conducted concerning the treatment of hypertension. Researchers randomly assigned 15 hypertensive subjects to one of two treatment groups. The subjects assigned to group one received a treatment regimen based on the first drug while those assigned to group two received a regimen based on the second drug. Descriptive statistics of the systolic blood pressure of each patient are shown below.

Variable	N	Mean	StDev
Group One	8	131.80	10.42
Group Two	7	135.20	12.53

6. **10 points** Conduct a test to see whether there is a difference in the variabilities of systolic blood pressures for similar patients on these two drugs. Show your hypotheses, the value of the test statistic, the rejection region, p-value, and give the conclusion in terms of the problem.

7. **2 points** What are the conditions necessary for the validity of the test above?

Questions 8-10: In one experiment to test the protective power of a tree resin against termites, eight dishes were prepared with filter paper treated with 5mg of the resin and eight dishes with filter paper treated with 10mg of the resin. Twenty-five termites were placed in each dish to feed on the filter paper. At the end of 15 days, the number of surviving termites in each of the 16 dishes was counted.

8. **2 points** What are the variables in this study?

9. **2 points** Define the relevant parameter(s) that would be appropriate to use in a hypothesis test or confidence interval.

10. **2 points** The two samples of data (from the two resin concentrations) are

- independent.
- paired.

Answers

1. If mean wages for all union and non-union nurses are the same, the probability of observing data at least as supportive of the VP's hunch as what we observed (sample mean for union at least \$.95 above that of non-union) is only .0183.

2. We'd use an independent samples z-test.

3. $H_0: \mu_{FiveYearsAgo} = \mu_{Now}$ $H_a: \mu_{FiveYearsAgo} > \mu_{nNow}$

$$t = 2.258 \quad RR: t > 1.729 \quad .01 < p - value < .025$$

We have enough evidence that the average percent of monthly income needed for housing for all New England homeowners five years ago was greater than now.

4. (0.459, 12.141)

This result agrees with our hypothesis test result because the interval includes only positive differences, i.e. it lies entirely in the space of the alternative hypothesis.

5. $H_0: p_{lastmonth} = p_{thismonth}$ $H_a: p_{lastmonth} < p_{thismonth}$

$$z = -1.29 \quad RR: z < -1.645 \quad p - value = .0985$$

$$95\% \text{ CI for } p_{lastmonth} - p_{thismonth}: (-.133, .027)$$

We do not have enough evidence that a larger proportion of all agents believe the economy is expanding this month compared to last month.

6. $H_0: \sigma_{One}^2 = \sigma_{Two}^2$ $H_a: \sigma_{One}^2 \neq \sigma_{Two}^2$

$$F = 1.446 \quad RR: F > 5.12 \quad p - value > .20$$

We do not have enough evidence of a difference in the variabilities of systolic blood pressures for similar patients on these two drugs.

7. We have random assignment to the two treatment groups which satisfies the random mechanism condition. The other condition is that the two samples of systolic blood pressures come from normal distributions.

8. concentration of resin; number of surviving termites

9. μ_5 = mean number of surviving termites (out of 25) for all such groups of 25 exposed to 5mg of resin
 μ_{10} = mean number of surviving termites (out of 25) for all such groups of 25 exposed to 10mg of resin

10. independent