

INSTRUCTIONS: Solve all of the following 5 problems and write your solutions on separate pages or using a computer. In either case, label your solutions clearly. Write your solutions clearly and explain proofs or other arguments using English words and sentences. You may use any non-living resource to help you during the exam: books, notes, the internet, R, etc. are all fine, but you may not ask anyone else for help.

1. *Resistance Training and Executive Functions: A 12-Month Randomized Controlled Trial* (Teresa Liu-Ambrose et al., Arch Intern Med. 2010;170(2):170-178. doi:10.1001/archinternmed.2009.494) reports on a study of the effects of exercise on the cognitive functions of elderly women. In the study one group of participants did twice-weekly resistance training (2xRT group), another did once-weekly resistance training (1xRT group), and the last group did balance and toning exercises (BAT group) for one year. Each group’s mean scores on the Stroop test before and after the year are reported below (lower scores are better) along with sample sizes and sample standard deviations. You may assume that populations are approximately normally distributed.

Group	Initial score	Final score
RTx2	$\bar{x} = 45.0$ $s = 15.8$ $n = 52$	$\bar{x} = 40.9$ $s = 14.9$ $n = 46$
RTx1	$\bar{x} = 47.4$ $s = 26.2$ $n = 54$	$\bar{x} = 39.5$ $s = 14.1$ $n = 47$
BAT	$\bar{x} = 44.0$ $s = 15.1$ $n = 49$	$\bar{x} = 43.8$ $s = 19.1$ $n = 42$

- a) Did any of the exercise regimens produce significant improvements in cognitive function (as measured by the Stroop test)?
- b) Did any of the exercise regimens produce significantly better (or worse) improvements than the others?
- c) It looks like the RTx1 group also had a marked decrease in the variance of scores on the Stroop test. Was this decrease significant?

2. A random sample of 40 fun-size bags of M&Ms was carefully analyzed to give the following data on the number of red M&Ms per package. Determine if it is plausible that the number of red M&Ms in a package has a binomial distribution.

Number of red M&Ms	0	1	2	3	4
Frequency	13	15	7	4	1

3. Another sample of 33 bags of fun-sized M&Ms was analyzed and the numbers of green and yellow M&Ms in each bag was recorded. The results are available at <http://web02.gonzaga.edu/faculty/axon/422/yellow-green.csv>.

- a) Fit a least squares line to the data.
- b) Calculate the sample correlation coefficient.
- c) Would it be appropriate to use normal correlation analysis to test for independence of our two variables? Why or why not?

4. Do students grow while they’re in college? Ask at least 8 first- or second-year students their heights and at least 8 fourth-year students their heights. Determine if your data could be significant evidence for students growing over their time in college. Address any assumptions you make in your analysis and any possible shortcomings in the procedure used to answer the question. What would be a better way to answer the question?

5. *Mood Food: Chocolate and Depressive Symptoms in a Cross-sectional Analysis* (Natalie Rose, Sabrina Koperski, Beatrice A. Golomb, Arch Intern Med. 2010;170(8):699-703. doi:10.1001/archinternmed.2010.78) reports on a study of 1018 adults who were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) and asked about their eating habits, particularly the amount of chocolate they consume. A CES-D score of 16 or more is considered to be a positive result when screening for depression. The following table summarizes the study’s findings. Write a short summary of the findings that the Gonzaga Health and Counseling Services staff could use in deciding whether or not to put a basket of chocolates out in their office.

Table. Consumption of Nutrients by CES-D Strata

Nutrient	CES-D Score		Relative Difference, %	P Value
	<16	≥16		
Chocolate, mean (SD) ^a	5.39 (8.76)	8.39 (14.83)	55.7	.004
Fat, mean (SD), g	68.1 (39.6)	74.6 (46.9)	9.5	.17
Energy intake, mean (SD), kcal	1681 (791)	1785 (958)	6.2	.24
Carbohydrates, mean (SD), g	187 (91)	198 (109)	5.9	.28
Caffeine, mean (SD), mg	148 (147)	158 (155)	1.1	.70

Abbreviation: CES-D, Center for Epidemiologic Studies–Depression Scale.
^aFred Hutchinson Food Frequency Questionnaire–chocolate servings-per-month measure.