DO NOT REMOVE FROM THE EXAM HALL

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浙江大学爱丁堡大学联合学院
ZJU-UoE INSTITUTE

Advanced Mathematics I

MATH1001

Exam Date:	Start time:	End time:	Duration:	Term:	Year:
Jan 6th	9:30	11:00	1.5 Hours	1st	2021/22

Marking Table

Part 1	Part 2	Part 3	Part 4	Part 5		
Part 6	Part 7	Part 8	Part 9	Part 10		Total

UNTIL INSTRUCTED DO NOT TURN TO THE NEXT PAGE

PLEASE WRITE YOUR UNIQUE IDENTIFYING NUMBER IN THE TOP LEFT HAND CORNER OF EVERY PAGE

PLEASE READ FULL INSTRUCTIONS BEFORE COMMENCING WRITING

Exam paper information

Total number of pages: 10

Number of questions: 10

Special instructions

1. This is a closed book and notes examination.

2. There is a total of 10 questions in the exam paper. You must answer all the questions.

3. Write your answer with black or black blue coloured pen in the blank area below each questions or sub-questions.

4. Stand-alone dictionary, calculators and statistical tables are allowed. To borrow stationery and dictionary in the exam hall is not allowed.

This examination will be marked anonymously

1. Researchers studied 1,718 persons over age 65 living in North Carolina. They found that those who attended religious services regularly were more likely to have strong immune systems (as determined by the blood levels of the protein interleukin-6) than those who didn't.

Does this mean that attending religious services improves one's health? Why or why not?

2. In a study of milk production in sheep (for use in making cheese), a researcher measured the 3-month milk yield for each of 11 ewes. The yields (liters) were as follows:

56.5, 89.8, 110.1, 65.6, 63.7, 82.6, 75.1, 91.5, 102.9, 44.4, 108.1

(a) Determine the median and the quartiles.

(b) Determine the interquartile range.

(c) Construct a boxplot of the data.

3. Childhood lead poisoning is a public health concern in the United States. In a certain population, 1 child in 8 has a high blood lead level (defined as 30 mg/dl or more). In a randomly chosen group of 16 children from the population, what is the probability that

(a) none has high blood lead?

(b) 1 has high blood lead?

(c) 2 have high blood lead?

(d) 3 or more have high blood lead?

4. The bill lengths of a population of male Blue Jays follow approximately a normal distribution with mean equal to 25.4 mm and standard deviation equal to 0.8 mm. Find the 95th percentile of the bill length distribution.

5. In a certain lab population of mice, the weights at 20 days of age follow approximately a normal distribution with mean weight = 8.3 gm and standard deviation = 1.7 gm. Suppose many litters of 10 mice each are to be weighed. If each litter can be regarded as a random sample from the population, what percentage of the litters will have a total weight of 80 gm or more?

6. As part of a study of the development of the thymus gland, researchers weighed the glands of five chick embryos after 14 days of incubation. The thymus weights (mg) were as follows:

29.6   21.5   28.0   34.6   44.9

For these data, the mean is 31.7 and the standard deviation is 8.7.

(a) Calculate the standard error of the mean.

(b) Construct a 90% confidence interval for the population mean.

7. Nutritional researchers conducted an investigation of two high-fiber diets intended to reduce serum cholesterol level. Twenty men with high serum cholesterol were randomly allocated to receive an "oat" diet or a "bean" diet for 21 days. The table summarizes the fall (before minus after) in serum cholesterol levels.

Fall in cholesterol (MG/DL)			
Diet	n	Mean	SD
Oat	10	53.6	31.1
Bean	10	55.5	29.4

Use a t test to compare the diets at the 5% significance level.

[Note: Formula (6.7.1) yields 17.9 df.]

8. Each of 36 men was asked to touch the foreheads of three women, one of whom was their romantic partner, while blindfolded. The two "decoy" women were the same age, height, and weight as the man's partner. Of the 36 men tested, 18 were able to correctly identify their partner.
Do the data provide sufficient evidence to conclude that men can do better than they would do by merely guessing? Conduct an appropriate test.

9. A researcher collected daffodils from four sides of a building and from an open area nearby. She wondered whether the average stem length of a daffodil depends on the side of the building on which it is growing. Summary statistics are given in the following table.
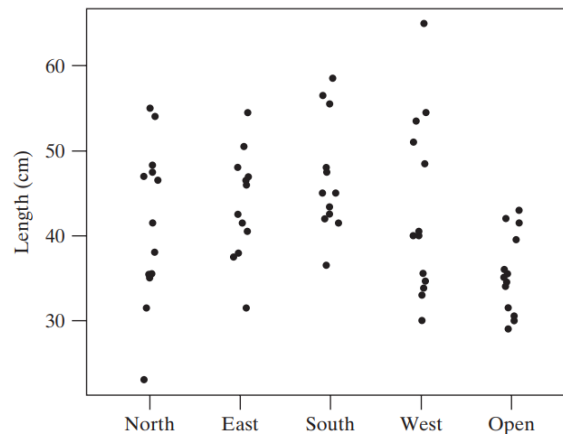
	North	East	South	West	Open
Mean	41.4	43.8	46.5	43.2	35.5
SD	9.3	6.1	6.6	10.4	4.7
n	13	13	13	13	13

The ANOVA SS(between) is 871.408 and the SS(within) is 3588.54.

(a) Dotplots of these data follow. Based on the dotplots, does it appear that the null hypothesis is true? Why or why not?

(b) State the null hypothesis in symbols.

(c) Construct the ANOVA table and test the null hypothesis. Let $\alpha = 0.10$

10. To investigate the dependence of energy expenditure on body build, researchers used underwater weighing techniques to determine the fat-free body mass for each of seven men. They also measured the total 24-hour energy expenditure for each man during conditions of quiet sedentary activity. The results are shown in the table.

Subject	Fat-free mass X (kg)	Energy expenditure Y (kcal)
1	49.3	1,894
2	59.3	2,050
3	68.3	2,353
4	48.1	1,838
5	57.6	1,948
6	78.1	2,528
7	76.1	2,568
Mean	62.400	2,168.429
SD	12.095	308.254
	$r = 0.98139$	

(a) The correlation between energy expenditure and fat-free mass is very large (near 1). It is 0.98139, but the sample size is quite small, only 7. Is there enough evidence to claim the correlation is different from zero? Carry out an appropriate test using $\alpha = 0.05$.

(b) Is this study an observational study or an experiment?

(c) Persons who exercise could increase their fat-free mass. Could these data be used to claim that their energy expenditure would also increase? If not, what could be said? Briefly explain.

(d) For these data, SS(resid) = 21,026.1. Construct a 95% confidence interval for β_1.