

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

Part I 為非選擇題，請將你的答案依題號寫在答案卷上

I. Short Questions: 4 questions, 2.5 points each

1. Please define a *Probability* problem by an example.
2. Please describe a *Statistics* situation based on your *Probability* problem in previous question.
3. Are there any similarities of your answers in the previous two questions?
4. Are there any differences of your answers in the first two questions?

Part II 為選擇題，請將你的答案依題號寫在答案卡上

II. Multiple Choice: 30 questions, 3 points each

1. Four hundred randomly sampled automobile owners were asked whether they selected the particular make and model of their present car mainly because of its appearance or because of its performance. The results were as follows.

Owner	Appearance	Performance	Total
Male	95	55	150
Female	85	165	250
Total	180	220	400

What is the probability that a female automobile owner buys the car mainly because of its appearance?

- ①. .47
 - ②. .34
 - ③. .56
 - ④. .21
2. Which of the following situations are possible applications of a Poisson random variable?
 - ①. The number of arrivals at a local movie theater.
 - ②. The number of files transferred through a computer network.
 - ③. The number of accidents reported during rush hour on a five-mile stretch of freeway.
 - ④. All of the above.
 3. A toy manufacturer is considering two types of material for producing a new toy ball. Each material is tested for its resistance to impact by producing a batch of toys using each material. A sample of 23 toys made of material 1 is tested with a sample mean impact strength of 55.23 psi (pounds per square inch) and sample standard deviation of 2.25 psi. A sample of 21 toys made from material 2 is tested with sample mean impact strength of 55.78 psi and a sample standard deviation of 3.46 psi. What is the value of the test statistic for testing whether material 1 has a greater standard deviation in impact strength than material 2 at a .1 level of significance?
 - ①. .990
 - ②. 1.54
 - ③. 1.24
 - ④. .423
 4. A manufacturer of storm windows sampled 250 new homes and found that 142 of them had storm windows. Another sample of 320 of older homes was taken; 150 of them had storm windows. The manufacturer believes that the proportion of new homes with storm windows (p_1) is larger than the proportion of old homes that have storm windows (p_2). Do the sample results support the manufacturer's belief at the .05 significance level? The value of the test statistic is
 - ①. 2.35
 - ②. 1.43
 - ③. 3.17
 - ④. 2.85
 5. An analyst of a marketing research group is interested in the effect of location and store size on the annual sales of a large discount department store chain. The analyst classifies the stores into four different locations (Factor A) and three different sizes (Factor B) with two replicates for each treatment. The sample results are as follows.

	Size 1	Size 2	Size 3
Northeast	20, 23	45, 36	89, 97
Southeast	17, 15	42, 24	99, 85
Southwest	21, 24	34, 38	78, 67
Midwest	26, 23	32, 37	86, 95

Find the SS(total).

- ①. 72,569
- ②. 20,277
- ③. 78,896
- ④. 7,889

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

6. Two hundred and fifty golf balls are distance-tested using an Iron Byron driving machine. The average distance traveled by this sample of golf balls was 376.95 yards, with a standard deviation of 8.16 yards. The spec limits are 375 ± 25 yards. The value of C_{pm} is

- ①. 1.1
- ②. .993
- ③. .948
- ④. 1.47

7. The following are the numbers of visible imperfections per Tudor dinner plate:

1 1 0 0 1 2 0 1 0 0 2 5 0 1

What is the upper control limit for a c-chart?

- ①. 1
- ②. 2
- ③. 3
- ④. 4

8. A manufacturer of bleach is interested whether the three brands currently on the market sell equally well. Supplies of the three brands were placed on a supermarket shelf. By the end of the month, 335 bottles of bleach had been sold as follows:

Bleach X	Bleach Y	Bleach Z
105	133	97

What is the critical value using a significance level of .10?

- ①. 5.10
- ②. 3.86
- ③. 4.61
- ④. 5.99

9. A study is being made of the relationship between family annual income (X), and annual expenditures on food (Y) in a native American community. Both variables are in \$1,000s. Below is the summary of the data.

$SS_x = 791.5$	$SS_y = 14$	$SP_{Cxy} = 100$
$n = 8$	$\bar{X} = 19.75$	$\bar{Y} = 3.5$

Calculate the correlation coefficient, r.

- ①. -.9500
- ②. .9025
- ③. .9500
- ④. -.8138

10. The following table shows a county's population, in thousands, from 1994 through 1998.

Year	t	Population
1994	1	240
1995	2	252
1996	3	260
1997	4	266
1998	5	270

What is the MAD for the forecasts with a least squares trend equation?

- ①. 1.98
- ②. 2.08
- ③. 2.60
- ④. 2.40

11. An accounting firm is concerned about the demand for its income tax services during peak periods. There are four states of nature (demand): low, medium, high, overflow. The personnel director is in charge of hiring temporary CPAs to fill in for any extra workload incurred during peak periods. The following table shows the utility benefits of hiring at different levels. Assume that each state of nature (demand) is equally probable.

Hiring	DEMAND			
	Low	Medium	High	Overflow
10 CPAs	80	50	30	10
15 CPAs	60	70	40	20
20 CPAs	40	80	50	40
25 CPAs	20	60	80	60
30 CPAs	10	40	70	90

What is the expected value of perfect information?

- ①. 82.5
- ②. 72.5
- ③. 62.5
- ④. 27.5

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

12. The numbers of daily absences in a school district were monitored for 36 school days in order to test whether the numbers of daily absences generate a random sequence. The data had nine runs with 14 observations above the median and 22 observations below the median. What is the conclusion of the test using a significance level of .01?
- ①. Reject H_0 , the sequence is not random.
 - ②. Fail to reject H_0 , the sequence appears to be random.
 - ③. Reject H_0 , the sequence appears to be random.
 - ④. Fail to reject H_0 , the sequence is not random.
13. The International Women's Forum (IWF) was founded in 1982 to give prominent women leaders in various professions around the world a way to share their knowledge with each other. A recent survey of the women in IWF revealed that the average yearly income for these women was \$142,573. Suppose that an independent polling agency questioned this figure and that a sample of 80 women from IWF yielded a mean of \$136,687 with a standard deviation of \$26,382. The question is whether there is sufficient evidence to conclude that the average yearly income for women in IWF is less than \$140,573, using a one percent significance level. The test procedure is to reject the H_0 if the computed value of the test statistic is
- ①. < -2.58 or > 2.58
 - ②. < -1.96 or > 1.96
 - ③. < -1.645
 - ④. < -2.33
14. The publication manager of a daily newspaper wishes to develop guaranteed circulation figures for use in soliciting advertising. A sample of 52 days shows that daily sales seem to be approximately normally distributed with a mean of 556,000 copies and a standard deviation of 8,000 copies. What would be the largest circulation figure to guarantee with no more than 5% risk of being caught short?
- ①. 553,826
 - ②. 554,175
 - ③. 553,029
 - ④. 553,143
15. In testing for differences between the means of two independent populations, the null hypothesis is:
- ①. $H_0: \mu_1 - \mu_2 = 2$.
 - ②. $H_0: \mu_1 - \mu_2 = 0$.
 - ③. $H_0: \mu_1 - \mu_2 > 0$.
 - ④. $H_0: \mu_1 - \mu_2 < 2$.
16. Given the following information, calculate s_p^2 , the pooled sample variance that should be used in the pooled-variance t test.
- | | |
|-------------|-------------|
| $s_1^2 = 4$ | $s_2^2 = 6$ |
| $n_1 = 16$ | $n_2 = 25$ |
- ①. $s_p^2 = 6$
 - ②. $s_p^2 = 5$
 - ③. $s_p^2 = 5.23$
 - ④. $s_p^2 = 4$
17. The life of an electronics component (i.e., the number of hours before failure) is exponentially distributed with a mean of 1000 hours. What is the probability that the component will fail before 500 hours?
- ①. .393
 - ②. .250
 - ③. .606
 - ④. .107
18. A carpet manufacturer is interested in determining which factors customers consider as measures of the quality of carpet. In a survey of 30 customers, information was collected on quality (Y), texture (X1), durability (X2), and price (X3). The market analyst uses multiple regression to formulate the following equation: $\hat{Y} = 34.56 + 5.21(X1) + 3.25(X2) + 2.15(X3)$. The coefficient of determination is .86, and the variance of the error terms $\sigma^2 = 4.67$. What is the critical value for testing the overall usefulness of the model at a .05 level of significance?
- ①. 2.96
 - ②. 3.37
 - ③. 2.98
 - ④. 2.73

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

TABLE 1

A certain type of rare gem serves as a status symbol for many of its owners. In theory, for low prices, the demand decreases as the price of the gem increases. However, experts hypothesize that when the gem is valued at very high prices, the demand increases with price due to the status owners believe they gain in obtaining the gem. Thus, the model proposed to best explain the demand for the gem by its price is the quadratic model: $Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \varepsilon$

where Y = demand (in thousands) and X = retail price per carat.

This model was fit to data collected for a sample of 12 rare gems of this type. A portion of the computer analysis obtained from Microsoft Excel is shown below:

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.994				
R Square	0.988				
Standard Error	12.42				
Observations	12				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Signif F</i>
Regression	2	115145	57573	373	0.0001
Residual	9	1388	154		
Total	11	116533			
	<i>Coeff</i>	<i>StdError</i>	<i>t Stat</i>	<i>P-value</i>	
Intercept	286.42	9.66	29.64	0.0001	
Price	-0.31	0.06	-5.14	0.0006	
Price Sq	0.000067	0.00007	0.95	0.3647	

19. Referring to Table 1, what is the value of the test statistic for testing whether there is an upward curvature in the response curve relating the demand (Y) and the price (X)?
- ①. -5.14
 - ②. 0.95
 - ③. 373
 - ④. None of the above.
20. Referring to Table 1, what is the p -value associated with the test statistic for testing whether there is an upward curvature in the response curve relating the demand (Y) and the price (X)?
- ①. 0.0001
 - ②. 0.0006
 - ③. 0.3647
 - ④. None of the above.
21. Referring to Table 1, does there appear to be significant upward curvature in the response curve relating the demand (Y) and the price (X) at 10% level of significance?
- ①. Yes, since the p value for the test is less than 0.10.
 - ②. No, since the value of β_2 is near 0.
 - ③. No, since the p value for the test is greater than 0.10.
 - ④. Yes, since the value of β_2 is positive.
22. A real estate analyst collects data on house sales over a four-year period. She wants to examine the data to determine trends, seasonality, and cyclical variation.

Month	1995	1996	1997	1998
Jan.	12	10	22	18
Feb.	10	8	12	11
Mar.	14	15	17	16
Apr.	16	17	18	15
May	20	22	24	19
Jun.	18	21	25	18
Jul.	15	18	26	21
Aug.	17	16	24	20
Sep.	19	16	23	16
Oct.	16	17	22	15
Nov.	14	15	20	14
Dec.	12	14	21	13

What is the deseasonalized trend line?

- ①. $12.4 - 1.4t$
- ②. $13.2 - .12t$
- ③. $14.6 + .18t$
- ④. $15.4 + .07t$

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

TABLE 2

The following EXCEL tables are obtained when "Score received on an exam (measured in percentage points)" (Y) is regressed on "percentage attendance" (X) for 22 students in a Statistics for Business and Economics course.

Regression Statistics

Multiple R	0.142620229
R Square	0.02034053
Adjusted R Square	-0.028642444
Standard Error	20.25979924
Observations	22

	<i>Coefficients</i>	<i>Standard Error</i>	<i>T Stat</i>	<i>P-value</i>
Intercept	39.39027309	37.24347659	1.057642216	0.302826622
Attendance	0.340583573	0.52852452	0.644404489	0.526635689

23. Referring to Table 2, which of the following statements is true?
- ①. -2.86% of the total variability in score received can be explained by percentage attendance.
 - ②. -2.86% of the total variability in percentage attendance can be explained by score received.
 - ③. 2% of the total variability in score received can be explained by percentage attendance.
 - ④. 2% of the total variability in percentage attendance can be explained by score received.
24. Referring to Table 2, which of the following statements is true?
- ①. If attendance increases by 0.341%, the estimated average score received will increase by 1 percentage point.
 - ②. If attendance increases by 1%, the estimated average score received will increase by 39.39 percentage points.
 - ③. If attendance increases by 1%, the estimated average score received will increase by 0.341 percentage points.
 - ④. If the score received increases by 39.39%, the estimated average attendance will go up by 1%.

TABLE 3

A perfume manufacturer is trying to choose between 2 magazine advertising layouts. An expensive layout would include a small package of the perfume. A cheaper layout would include a "scratch-and-sniff" sample of the product. The manufacturer would use the more expensive layout only if there is evidence that it would lead to a higher approval rate. The manufacturer presents both layouts to 5 groups and determines the approval rating from each group on both layouts. The data are given below. Use this to test whether the median difference in approval rating is different from zero in favor of the more expensive layout with a level of significance of 0.05.

<u>Package</u>	<u>Scratch</u>
52	37
68	43
43	53
48	39
56	47

25. Referring to Table 3, what is the right test to use?
- ①. Wilcoxon rank sum test for difference in median
 - ②. Wilcoxon rank sum test for median difference
 - ③. Wilcoxon signed rank test for difference in median
 - ④. Wilcoxon signed rank test for median difference
26. Referring to Table 3, the hypotheses that should be used are:
- ①. $H_0 : M_D = 0$ versus $H_1 : M_D \neq 0$
 - ②. $H_0 : M_D \leq 0$ versus $H_1 : M_D > 0$
 - ③. $H_0 : M_1 = M_2$ versus $H_1 : M_1 \neq M_2$
 - ④. $H_0 : M_1 \leq M_2$ versus $H_1 : M_1 > M_2$

招生學年度	101	招生類別	碩士班
系所班別	國際企業學系碩士班、企業管理學系碩士班(甲組)、運籌管理研究所碩士班(甲組、乙組)、財務金融學系碩士班		
科目	統計學		
注意事項	本考科可使用掌上型計算機		

TABLE 4

A campus researcher wanted to investigate the factors that affect visitor travel time in a complex, multilevel building on campus. Specifically, he wanted to determine whether different building signs (building maps versus wall signage) affect the total amount of time visitors require to reach their destination and whether that time depends on whether the starting location is inside or outside the building. Three subjects were assigned to each of the combinations of signs and starting locations, and travel time in seconds from beginning to destination was recorded. An Excel output of the appropriate analysis is given below:

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Signs	14008.33		14008.33		0.11267	5.317645
Starting Location	12288			2.784395	0.13374	5.317645
Interaction	48		48		0.919506	5.317645
Within	35305.33		4413.167			
Total	61649.67	11				

27. Referring to Table 4, the degrees of freedom for the different building signs (factor A) is

- ①. 1
- ②. 2
- ③. 3
- ④. 8

28. Referring to Table 4, the within (error) degrees of freedom is

- ①. 1
- ②. 4
- ③. 8
- ④. 11

29. Referring to Table 4, the mean squares for starting location (factor B) is

- ①. 48
- ②. 4,413.17
- ③. 12,288
- ④. 14,008.3

30. Referring to Table 4, the F test statistic for testing the interaction effect between the types of signs and the starting location is

- ①. 0.0109
- ②. 2.7844
- ③. 3.1742
- ④. 5.3176