國立政治大學　105　學年度碩士班招生考試試題

考試科目	統計學 4/7/12	所別	財務管理學系	考試時間	2 月 27 日(六) 第三節

I. Single choice questions (3 points each)　　選擇題請在答案卡上作答，否則不予計分。

Some upper quantiles for N(0,1): $z_{0.01} = 2.33$, $z_{0.025} = 1.96$, $z_{0.05} = 1.65$, $z_{0.1} = 1.28$

1. The table below shows the result of a survey regarding the rating of 180 hedge fund managers.

poor	fair	excellent
80	60	40

Which of the following measure is meaningful for this data?

(a) Mean.
(b) Range.
(c) Median.
(d) None of the above.

2. Let X_1, X_2 be a random sample of 2 measurements selected from a population with probability distribution $P(X = 0) = 0.2$, $P(X = 1) = 0.3$, and $P(X = 2) = 0.5$. Find the variance of the sample mean $\bar{X}_2$.

(a) 1.22
(b) 0.61
(c) 0.305
(d) None of the above.

3. A financial company has recruited 50 employees over the past two years. Each employee is classified according to gender and major. The result is given in the following table.

	female	male
science	2	4
engineering	6	8
business	16	14

What is the probability that a randomly selected female will major in business?

(a) 2/3
(b) 3/5
(c) 12/25
(d) None of the above.

4. Which of the following plots can *not* be used to check normality?

(a) QQ-plot.
(b) Histogram.
(c) Stemplot.
(d) None of the above.

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

考試科目	統計學 4171	所別	財務管理學系	考試時間	2月27日(六)第三節

5. The return on investment earned by Company A for three successive years was: 14 percent, -6 percent, and 5 percent, where the total return each year is reinvested for the next year. Find the annual rate of return on investment.
   (a) 1 percent
   (b) 2 percent
   (c) 4 percent
   (d) None of the above.

6. Which of the following statements is true?
   (a) Poisson(λ), $\lambda > 0$, can be approximated by Binomial($n, \lambda/n$) when n is large enough.
   (b) The variance of a Poisson(λ) random variable is 2λ.
   (c) The hypergeometric distribution describes the probability of x successes in n draws with replacement, where each draw is either a success or a failure.
   (d) None of the above.

7. Let X be the number of heads in 100 tosses of a fair coin. What can we say about the probability of the event $\{X > 40\}$?
   (a) Greater than 0.95.
   (b) Between 0.95 and 0.75.
   (c) Between 0.75 and 0.5.
   (d) Less than 0.5.

8. A box contains 5000 balls with 3000 red and 2000 black. Two hundred balls are randomly selected from the box without replacement. Let X denote the number of red balls among the 200 selected balls. What can we say about the probability of the event $\{X > 100\}$?
   (a) Greater than 0.95.
   (b) Between 0.95 and 0.75.
   (c) Between 0.75 and 0.5.
   (d) Less than 0.5.

9. Which of the following statements is true?
   (a) In stratified random sampling strata are more homogeneous.
   (b) In cluster random sampling, clusters are internally homogeneous.
   (c) Systematic sampling is also called snowball sampling.
   (d) None of the above.

10. Determining an appropriate sample size requires an estimate about standard deviation, which may be obtained via a *pilot study*. What does a *pilot study* mean?
    (a) It is a study involving aircraft engineering.
    (b) It is a preliminary analysis.
    (c) It is about aviation training.
    (d) None of the above.

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11. A manufacturer would like to purchase silver rods with a diameter of 12mm. A random sample of silver rods are selected from the incoming shipments to test whether the diameter is 12mm. What are the null and alternate hypotheses?
    (a) $H_0 : \mu =$12mm vs $H_1 : \mu >$12mm
    (b) $H_0 : \mu =$12mm vs $H_1 : \mu \neq$12mm
    (c) $H_0 : \mu \neq$12mm vs $H_1 : \mu =$12mm
    (d) $H_0 : \mu =$12mm vs $H_1 : \mu <$12mm

12. (continued) Suppose that the sample standard deviation based on 100 randomly selected rods is 0.5mm, and that the manufacturer decides to accept the shipments if the sample mean lies between 11.936mm and 12.064mm. What is the probability of rejecting the H_0 when it is true?
    (a) 0.05
    (b) 0.1
    (c) 0.2
    (d) None of the above.

13. We are to estimate the percentage of college students who shop online. At 98% confidence, about what sample size would be necessary in order for the margin of error to be about 0.04?
    (a) 426
    (b) 602
    (c) 848
    (d) None of the above.

14. We are interested in the amount of time per week spending on Internet among college students. Let μ denote the population mean. Based on a randomly selected sample, the sample mean is 31 hours and the 95% confidence interval is (28,34). Which of the following statements is true?
    (a) The probability that μ lies in (28,34) is 0.95.
    (b) The probability that the sample mean lies in (28,34) is 0.95.
    (c) About 95% of similarly constructed confidence interval will cover the sample mean.
    (d) None of the above.

15. (continued) Consider the hypothesis testing $H_0 : \mu = 30$ vs $H_1 : \mu \neq 30$. Which of the following statements is true?
    (a) The p-value is less than 0.01.
    (b) H_0 is rejected.
    (c) H_0 is not rejected.
    (d) There is not enough information to draw a conclusion.

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16. Two candidates (Alice and Bob) are ranked by 5 recruiting committee members (A,B,C,D,E). The result is below. Compare the Pearson's correlation coefficient r and the Spearman's rank correlation coefficient r_s for this dataset.

member	A	B	C	D	E
Alice	3	2	1	5	4
Bob	2	1	3	4	5

(a) $0 < r < r_s$.

(b) $0 < r_s < r$.

(c) $r = r_s$.

(d) None of the above.

17. Which of the following statements is correct?

(a) Goodness-of-fit tests only apply to categorical data.

(b) Non-parametric methods make more assumptions on the model distribution.

(c) Spearman's rank correlation coefficient is less sensitive to outliers when compared to Pearson's correlation coefficient.

(d) None of the above.

18. Consider the analogy question: *two independent samples t-test* is to *paired samples t-test* as

(a) *Kruskal-Wallis test* is to *Analysis of variance.*

(b) *The sign test* is to *Wilcoxon signed-rank test.*

(c) *Wilcoxon rank-sum test* is to *Wilcoxon signed-rank test.*

(d) None of the above.

19. Which of the following is for testing serial independence?

(a) Shapiro-Wilk test.

(b) Durbin-Watson test.

(c) Phillips-Perron test.

(d) None of the above.

20. Which of the following measures multicollinearity?

(a) Variance inflation factor.

(b) Multiple standard error of estimate.

(c) Coefficient of determination.

(d) None of the above.

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考試科目	統計學 4107	所別	財務管理學系	考試時間	2月27日(六)第三節

II. Short-answer questions

1. The nationwide union made a proposal that emphasizes fringe benefits rather than wage increases. We are interested in whether female union members hold different opinions from male members. Denote by π_m and π_f the percentages of male and female members, respectively, who favor the proposal. The opinions of 1,000 randomly selected members are below.

	favor	opposed
female	300	200
male	250	250

   (a) (4 points) Let X_i be 1 if the ith selected female member favors the proposal. What is the probability distribution of X_i? (Specify the parameter of the distribution if there is any.)

   (b) (10 points) At $\alpha = 0.02$, test whether π_m is equal to π_f. (Write down H_0, H_1, test statistic, critical value, and conclusion.)

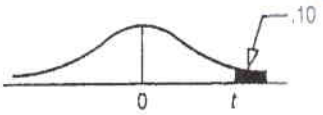
   (c) (10 points) At $\alpha = 0.02$, use a chi-square test to determine whether 'opinion' and 'gender' are independent. (Write down H_0, H_1, test statistic, critical value, and conclusion.)

2. We are to study the relationship between firm profitability and advertising expenditures. A random sample of ten companies are selected for study. The table below shows the profit (return on equity) and the advertising expenditures (in thousand).

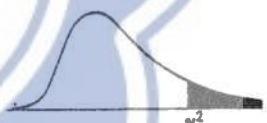
Profit (percent)	20	20	18	16	15	10	5	-3	-5	-8
Ad expenditures	150	160	120	130	150	90	100	30	30	20

   (a) (6 points) Let 'profit' be the dependent variable. Find the regression equation.

   (b) (10 points) At $\alpha = 0.05$, test whether the slope parameter in the regression model is zero.



Example: With *df*=9 and .10 area in the upper tail, *t*=1.383



Possible values of χ^2

	Confidence Intervals					
	80%	90%	95%	98%	99%	99.9%
	Level of Significance for One-Tailed Test					
df	0.100	0.050	0.025	0.010	0.005	0.0005
	Level of Significance for Two-Tailed Test					
	0.20	0.10	0.05	0.02	0.01	0.001
1	3.078	6.314	12.706	31.821	63.657	636.619
2	1.886	2.920	4.303	6.965	9.925	31.599
3	1.638	2.353	3.182	4.541	5.841	12.924
4	1.533	2.132	2.776	3.747	4.604	8.610
5	1.476	2.015	2.571	3.365	4.032	6.869
6	1.440	1.943	2.447	3.143	3.707	5.959
7	1.415	1.895	2.365	2.998	3.499	5.408
8	1.397	1.860	2.306	2.896	3.355	5.041
9	1.383	1.833	2.262	2.821	3.250	4.781
10	1.372	1.812	2.228	2.764	3.169	4.587
11	1.363	1.796	2.201	2.718	3.106	4.437
12	1.356	1.782	2.179	2.681	3.055	4.318
13	1.350	1.771	2.160	2.650	3.012	4.221
14	1.345	1.761	2.145	2.624	2.977	4.140

Degrees of Freedom, *df*	Right-Tail Area			
	0.10	0.05	0.02	0.01
1	2.706	3.841	5.412	6.635
2	4.605	5.991	7.824	9.210
3	6.251	7.815	9.837	11.345
4	7.779	9.488	11.668	13.277
5	9.236	11.070	13.388	15.086
6	10.645	12.592	15.033	16.812
7	12.017	14.067	16.622	18.475
8	13.362	15.507	18.168	20.090
9	14.684	16.919	19.679	21.666
10	15.987	18.307	21.161	23.209
11	17.275	19.675	22.618	24.725
12	18.549	21.026	24.054	26.217
13	19.812	22.362	25.472	27.688
14	21.064	23.685	26.873	29.141

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。