國立臺灣大學 110 學年度碩士班招生考試試題

Multiple Choice ※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. Let $\bar{X} = 3600.7$ and $S^2 = 14655$ be the sample mean and variance of the weights of nineteen neonates in grams. Suppose that there was a typewriting error in the eighth observation, the accurate weight of eighth neonate, 4320 was recorded as 4230. After we correct it, what are the accurate sample mean and variance
   (A) Sample mean: 3605.44, Variance: 20274.32
   (B) Sample mean: 3605.44, Variance: 21175.7
   (C) Sample mean: 3609.23, Variance: 22437.62
   (D) Sample mean: 3609.23, Variance: 23416.3

2. Let A and B be the events such that $P(A) = 0.4, P(B) = 0.6,$ and $P(A^C \cap B^C) = \frac{1}{3}$. Then $P(A \cup B^C) = ?, P(A^C \cup B^C) = ?$
   (A) $P(A \cup B^C) = \frac{7}{15}, P(A^C \cup B^C) = \frac{2}{3}$
   (B) $P(A \cup B^C) = \frac{11}{18}, P(A^C \cup B^C) = \frac{5}{6}$
   (C) $P(A \cup B^C) = \frac{4}{21}, P(A^C \cup B^C) = \frac{2}{3}$
   (D) $P(A \cup B^C) = \frac{5}{24}, P(A^C \cup B^C) = \frac{5}{6}$

3. Suppose that a firm's sales were $2,500,000 four year ago, and sales have grown annually by 15%, 15%, -10%, 5% since that time. What was the mean growth rate in sales over the past four years?
   (A) 6%
   (B) 17%
   (C) 25%
   (D) 33%

4. An insurance company believes that people can be divided into two classes - those are accident-prone and those are not. Their statistics show that an accident-prone person will have an accident at some time within a fixed 1-year period with probability 0.5, whereas this probability decreases to 0.4 for a non-accident-prone person. If we assume that 40% of the population is accident-prone, what is the probability that a new policy holder will have an accident within a year of purchasing this policy?
   (A) 0.44
   (B) 0.45
   (C) 0.46
   (D) 0.47

5. Given the probabilities of some of events as follows: $P(C|B) = 0.95$, $P(C|B^C) = 0.3$, $P(A|B \cap C) = 0.2$, $P(A|B^C \cap C) = 0.05$, $P(A|B \cap C^C) = 0.35$, $P(A|B^C \cap C^C) = 0.2$. Compute $P(A|B)$.
   (A) 0.2021
   (B) 0.2075
   (C) 0.2098
   (D) 0.2132

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6. A Bayesian approach can be used to revise probabilities that a prospect field will produce oil. In one case, geological assessment indicates a 25% chance that the field will produce oil. Further, there is an 80% chance that particular well will strike oil given that oil is present in the prospect filed. Suppose that one well is drilled on the field and it comes up dry. What is the probability that the prospect filed will produce oil?
(A) 0.0333
(B) 0.0425
(C) 0.0625
(D) 0.0675

7. Suppose we took a pair of random samples (X_1, X_2), with replacement from population f(x):

X	0	1	2	3
f(x)	0.1	0.4	0.3	0.2

Find $E(\bar{X})$ and $P(\bar{X} > 1)$
(A) $E(\bar{X}) = 1.4$, $P(\bar{X} > 1)=0.50$
(B) $E(\bar{X}) = 1.4$, $P(\bar{X} > 1)=0.49$
(C) $E(\bar{X}) = 1.6$, $P(\bar{X} > 1)=0.69$
(D) $E(\bar{X}) = 1.6$, $P(\bar{X} > 1)=0.71$

8. The Sutton police department must write, on average, 6 tickets a day to keep department revenues at budgeted levels. Suppose the number of tickets written per day follows a Poisson distribution with a mean of 6.5 tickets per day. Interpret the value of the mean.
(A) The mean has no interpretation.
(B) The expected number of tickets written would be 6.5 per day.
(C) Half of the days have less than 6.5 tickets written and half of the days have more than 6.5 tickets written.
(D) The number of tickets that is written most often is 6.5 tickets per day.

9. A firm manufactures metal rods which must be rejected if they are not between 6.025 and 6.475 cm in diameter. The expect value of the diameter of the rods is 6.25 cm, and the standard deviation of these diameter is 0.035 cm. What is the maximum probability that a rod will be rejected?
(A) 0.0531
(B) 0.0444
(C) 0.0357
(D) 0.0242

10. Consider the infinite population described by the probability distribution show here.

X	0	1	2
f(x)	0.3	0.4	0.3

Assume a random sample of $n = 80$ measurements is selected from the population, find the sampling distribution of the sample mean $\bar{X}$ and calculate $P(0.905 < \bar{X} < 1.095)$
(A) $\bar{X} = 1$, $P(0.905 < \bar{X} < 1.905) = 0.7330$
(B) $\bar{X} = 1$, $P(0.905 < \bar{X} < 1.905) = 0.6578$
(C) $\bar{X} = 1.2$, $P(0.905 < \bar{X} < 1.905) = 0.7920$
(D) $\bar{X} = 1.2$, $P(0.905 < \bar{X} < 1.905) = 0.9505$

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11. Suppose that A, B and C are three independent events such that $P(A) = 0.6,\ P(B) = 0.4,\ P(C) = 0.2$. What is the probability that exactly one of these three events will occur?
(A) 0.371
(B) 0.398
(C) 0.407
(D) 0.464

12. If X, Y, Z are positive valued and all have means of 5 and standard deviations of 3, estimate the probability that the average of X, Y, and Z is less than 10 by Chebyshev's inequality. If X, Y and Z all have correlation coefficients of 0.3.
(A) $\frac{29}{31}$
(B) $\frac{47}{51}$
(C) $\frac{102}{111}$
(D) $\frac{125}{129}$

13. If the random variable X is exponentially distributed, then the mean of X will be:
(A) greater than the median.
(B) less than the median.
(C) equal to the median.
(D) Cannot tell; the answer depends on what λ is.

14. If $n = 100$ and the number of successes is 49 for a random sample from a binomial population, find the estimates for the variance of the sample proportion of successes $\sigma_{\hat{p}}^2$
(A) 0.0018
(B) 0.0025
(C) 0.0033
(D) 0.0049

15. In testing the difference between the means of two normally distributed populations, the number of degrees of freedom associated with the unequal-variances t-test statistic usually results in a non-integer number. It is recommended that you:
(A) round to the nearest integer.
(B) change the sample sizes until the number of degrees of freedom becomes an integer.
(C) assume that the population variances are equal, and then use df = $n_1 + n_2 - 2$
(D) None of these choices.

16. When testing $H_0: \mu_1 - \mu_2 = 0$ vs. $H_1: \mu_1 - \mu_2 \neq 0$, the observed value of the z-score was found to be -2.15. Then, the p-value for this test would be
(A) 0.0158
(B) 0.0316
(C) 0.9842
(D) 0.9684

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17. According to Chebyshev's inequality, the probability that in n throws of a fair die the number of fives lies between $\frac{n}{6} - (3n)^{\frac{1}{4}}$ and $\frac{n}{6} + (3n)^{\frac{1}{4}}$ is greater than or equal to

(A) $1 - \frac{\sqrt{3n}}{6}$

(B) $1 - \frac{5\sqrt{3n}}{36}$

(C) $1 - \frac{5\sqrt{3n}}{72}$

(D) $1 - \frac{5\sqrt{3n}}{108}$

18. In the NBA final, Lakers and Nets play a sequence of games and the first team that wins a total of four games becomes the champion. If the probability that Lakers win a particular game over Nets is 0.6. What is the probability that Lakers will become the champion?

(A) 0.6102
(B) 0.6307
(C) 0.6934
(D) 0.7102.

19. When the effect of a level for one factor depends on which level of another factor is present, the most appropriate ANOVA design to use in this situation is the:

(A) One-way ANOVA with 2 treatments.
(B) Two-factor ANOVA with interaction.
(C) Two-factor ANOVA with no interaction.
(D) None of these choices

20. A hotel chain has identically size resorts in 5 locations. The data that follow resulted from analyzing the Hotel occupancies on randomly selected days in the 5 locations.

Row	Caymen	Pennkamp	California	Mayaguze	Maui
1	28	40	21	37	22
2	33	35	21	47	19
3	41	33	27	45	25

Analysis of Variance

Source	df	SS	MS	F	p
Location	4	963.6			
Error	10	210.0			
Total					

Referring to the above table, the value of the element in the ANOVA table that always provides an estimate of the population variance is_____.

(A) 9.16
(B) 21.0
(C) 240.9
(D) 261.9

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21. A 95% confidence interval estimate can be interpreted to mean that
(A) If all possible samples of size N are taken and confidence interval estimates are developed, 95% of them would include the true population mean somewhere within their interval.
(B) We have 95% confidence that we have selected a sample whose interval does include the population mean.
(C) Both above.
(D) None of the above.

22. Suppose a 99% confidence interval for μ turns out to be (100, 200). To make more useful inferences from the data, it is desired to reduce the width of the confidence interval. Which of the following will result in a reduced interval width?
(A) Increase the sample size.
(B) Increase the confidence level.
(C) Increase the population mean.
(D) Increase the sample mean.
(E) None of the above.

23. Which of the following is not true about the Student's t distribution?
(A) It has more area in the tails and less in the center than does the normal distribution.
(B) It is used to construct confidence intervals for the population mean when the population standard deviation is known.
(C) It is bell shaped and symmetrical.
(D) As the number of degrees of freedom increases, the t distribution approaches the normal distribution.
(E) None of the above.

24. If the p-value is less than α in a two-tail test, .
(A) the null hypothesis should not be rejected.
(B) the null hypothesis should be rejected.
(C) a one-tail test should be used.
(D) no conclusion should be reached.
(E) None of the above.

25. If the Type I error (α) for a given test is to be decreased, then for a fixed sample size n
(A) the Type II error (β) will also decrease.
(B) the Type II error (β) will increase.
(C) the power of the test will increase.
(D) a one-tail test must be utilized.
(E) None of the above.

26. Suppose we wish to test H_0: $\mu \leq 45$ versus H_1: $\mu > 45$. What will result if we conclude that the mean is greater than 45 when its true value is really 52?
(A) We have made a Type I error.
(B) We have made a Type II error.
(C) We have made a correct decision
(D) None of the above are correct.

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27. You have created a 95% confidence interval for μ with the result $10 \leq \mu \leq 15$. What decision will you make if we test H_0: $\mu = 17$ versus H_1: $\mu \neq 17$ at $\alpha = 0.10$?
(A) Reject H_0 in favor of H_1.
(B) Do not reject H_0 in favor of H_1.
(C) Fail to reject H_0 in favor of H_1.
(D) We cannot tell what our decision will be from the information given.
(E) None of the above.

28. Which of the following statements is not true about the level of significance in a hypothesis test?
(A) The larger the level of significance, the more likely you are to reject the null hypothesis.
(B) The level of significance is the maximum risk we are willing to accept in making a Type I error.
(C) The significance level is also called the α level.
(D) The significance level is another name for Type II error.
(E) None of the above.

29. In performing a regression analysis involving two numerical variables, you are assuming
(A) the variances of X and Y are equal.
(B) the variation around the line of regression is the same for each X value.
(C) that X and Y are independent.
(D) All of the above.
(E) None of the above.

30. If the correlation coefficient (r) = 1.00, then .
(A) the Y-intercept (b_0) must equal 0.
(B) the explained variation equals the unexplained variation.
(C) there is no unexplained variation.
(D) there is no explained variation.
(E) None of the above.

31. Testing for the existence of correlation is equivalent to
(A) testing for the existence of the slope (β_1).
(B) testing for the existence of the Y-intercept (β_0).
(C) the confidence interval estimate for predicting Y.
(D) None of the above.

32. In the regression analysis, the width of the prediction interval for the predicted value of Y is dependent on
(A) the standard error of the estimate.
(B) the value of X for which the prediction is being made.
(C) the sample size.
(D) All of the above.
(E) None of the above.

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An economist is interested to see how consumption for an economy (in $ billions) is influenced by gross domestic product ($ billions) and aggregate price (consumer price index). The Microsoft Excel output of this regression is partially reproduced below. Use the information to answer question 33~38.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.991
R Square	0.982
Adjusted R Square	0.976
Standard Error	0.299
Observations	10

ANOVA

	df	SS	MS	F	Signif F
Regression	2	33.4163	16.7082	186.325	0.0001
Residual	7	0.6277	0.0897		
Total	9	34.0440			

	Coeff	StdError	t Stat	P-value
Intercept	–0.0861	0.5674	–0.152	0.8837
GDP	0.7654	0.0574	13.340	0.0001
Price	–0.0006	0.0028	–0.219	0.8330

33. When the economist used a simple linear regression model with consumption as the dependent variable and GDP as the independent variable, he obtained an R^2 value of 0.971. What additional percentage of the total variation of consumption has been explained by including aggregate prices in the multiple regression?
(A) 98.2
(B) 11.1
(C) 2.8
(D) 1.1
(E) None of the above.

34. What is the predicted consumption level for an economy with GDP equal to $4 billion and an aggregate price index of 150?
(A) $1.39 billion
(B) $2.89 billion
(C) $4.75 billion
(D) $9.45 billion
(E) None of the above.

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35. What is the estimated mean consumption level for an economy with GDP equal to $4 billion and an aggregate price index of 150?
(A) $1.39 billion
(B) $2.89 billion
(C) $4.75 billion
(D) $9.45 billion
(E) None of the above.

36. One economy in the sample had an aggregate consumption level of $4 billion, a GDP of $6 billion, and an aggregate price level of 200. What is the residual for this data point?
(A) $4.39 billion
(B) $0.39 billion
(C) – $0.39 billion
(D) – $1.33 billion
(E) None of the above.

37. To test for the significance of the coefficient on aggregate price index, the p-value is
(A) 0.0001
(B) 0.8330
(C) 0.8837
(D) 0.9999
(E) None of the above.

38. To test whether aggregate price index has a negative impact on consumption, the p-value is _____?
(A) 0.0001
(B) 0.4165
(C) 0.8330
(D) 0.8837
(E) None of the above.

39. An interaction term in a multiple regression model may be used when
(A) the coefficient of determination is small.
(B) there is a curvilinear relationship between the dependent and independent variables.
(C) neither one of 2 independent variables contribute significantly to the regression model.
(D) the relationship between X_1 and Y changes for differing values of X_2.
(E) None of the above.

40. A microeconomist wants to determine how corporate sales are influenced by capital and wage spending by companies. She proceeds to randomly select 26 large corporations and record information in millions of dollars. A statistical analyst discovers that capital spending by corporations has a significant inverse relationship with wage spending. What should the microeconomist who developed this multiple regression model be particularly concerned with?
(A) Randomness of error terms
(B) Collinearity
(C) Normality of residuals
(D) Missing observations
(E) None of the above.

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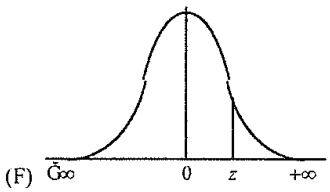
NORMAL DISTRIBUTION TABLE



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.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

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