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一、單選題(50%，每題2分)：

1. A campus program evenly enrolls undergraduate and graduate students. If a random sample of 4 students is selected from the program to be interviewed about the introduction of a new fast food outlet on the ground floor of the campus building, what is the probability that all 4 students selected are undergraduate students?
   (A) 0.0256
   (B) 0.0625
   (C) 0.16
   (D) 0.25
   (E) 1.00

2. If $n = 10$ and $p = 0.70$, then the standard deviation of the binomial distribution is
   (A) 0.07
   (B) 0.70
   (C) 1.45
   (D) 7.00
   (E) 14.29

3. Why is the Central Limit Theorem so important to the study of sampling distributions?
   (A) It allows us to disregard the size of the sample selected when the population is not normal.
   (B) It allows us to disregard the shape of the sampling distribution when the size of the population is large.
   (C) It allows us to disregard the size of the population we are sampling from.
   (D) It allows us to disregard the shape of the population when n is large.
   (E) It allows us to disregard the shape of the sampling distribution when the shape of the population is normal.

4. Which of the following about the normal distribution is not true?
   (A) Theoretically, the mean, median, and mode are the same.
   (B) About 2/3 of the observations fall within ±1 standard deviation from the mean.
   (C) It is a discrete probability distribution.
   (D) It is symmetric around the median.
   (E) Its standard version has 0 as mean and 1 as standard deviation.

5. Which of the following is not a reason for the need for sampling?
   (A) It is usually too costly to study the whole population.
   (B) It is usually too time consuming to look at the whole population.
   (C) It is sometimes destructive to observe the entire population.
   (D) It is always more informative by investigating a sample than the entire population.
   (E) With large enough sample size, sampling provide sufficient inference.

見 table 附於第七頁

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6. For some positive value of X, the probability that a standard normal variable is between 0 and $+2X$ is 0.1255. The value of X is
   (A) 0.99
   (B) 0.75
   (C) 0.40
   (D) 0.32
   (E) 0.16

7. If we know that the length of time it takes a college student to find a parking spot in the library parking lot follows a normal distribution with a mean of 3.5 minutes and a standard deviation of 1 minute, find the probability that a randomly selected college student will take between 2 and 4.5 minutes to find a parking spot in the library parking lot.
   (A) 0.0919
   (B) 0.1055
   (C) 0.2255
   (D) 0.4938
   (E) 0.7745

8. The standard error of the mean
   (A) is never larger than the standard deviation of the population.
   (B) decreases as the sample size increases.
   (C) measures the variability of the mean from sample to sample.
   (D) can only be calculated with a known sample size.
   (E) All of the above.

9. In performing a regression analysis involving two numerical variables, we are assuming
   (A) the variances of X and Y are equal.
   (B) the means of X and Y are equal.
   (C) the variation around the line of regression is the same for each X value.
   (D) that X and Y are independent.
   (E) All of the above.

10. A company has 125 personal computers. The probability that any one of them will require repair on a given day is 0.025. To find the probability that exactly 20 of the computers will require repair on a given day, one will use what type of probability distribution?
   (A) chi-squared distribution.
   (B) binomial distribution.
   (C) Poisson distribution.
   (D) hypergeometric distribution.
   (E) none of the above.

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11. If the expectation of a sampling distribution is located at the parameter it is estimating, then we call that sampling distribution
(A) unbiased.
(B) minimum variance.
(C) biased.
(D) random.
(E) inconsistent.

12. The standard error of the estimate is a measure of
(A) total variation of the Y variable.
(B) the variation around the sample regression line.
(C) explained variation.
(D) the variation of the X variable.
(E) the variation of the error term.

13. Sales prices of baseball cards from the 1960s are known to possess a skewed-right distribution with a mean sale price of \$5.25 and a standard deviation of \$2.80. Suppose a random sample of 100 cards from the 1960s is selected. Describe the sampling distribution for the sample mean sale price of the selected cards.
(A) Skewed-right with a mean of \$5.25 and a standard error of \$2.80.
(B) Normal with a mean of \$5.25 and a standard error of \$0.28.
(C) Skewed-right with a mean of \$5.25 and a standard error of \$0.28.
(D) Normal with a mean of \$5.25 and a standard error of \$2.80.
(E) Skewed-right with a mean of \$6.25 and a standard error of \$2.80.

14. The owner of a fish market has an assistant who has determined that the weights of catfish are normally distributed, with mean of 3.2 pounds and standard deviation of 0.8 pound. If a sample of 25 fish yields a mean of 3.6 pounds, what is the Z-score for this observation?
(A) 18.750
(B) 2.500
(C) 1.875
(D) 0.750
(E) 0.005

15. If the Durbin-Watson statistic has a value close to 0, which assumption is violated?
(A) Normality of the errors.
(B) Independence of errors.
(C) Homoscedasticity.
(D) Random sampling.
(E) None of the above.

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16. When testing H_0: $\mu_1 - \mu_2 = 0$ verse H_1: $\mu_1 - \mu_2 \neq 0$, the observed value of the Z-score was found to be -2.13. The p value for this test would be
(A) 0.0166.
(B) 0.0332.
(C) 0.1660.
(D) 0.9668.
(E) 0.9834.

17. Which of the following statements about the sampling distribution of the sample mean is incorrect?
(A) The sampling distribution of the sample mean is approximately normal whenever the sample size is sufficiently large (i.e. $n > 30$).
(B) The sampling distribution of the sample mean is generated by repeatedly taking samples of size n and computing the sample means.
(C) The mean of the sampling distribution of the sample mean is equal to population mean, μ.
(D) The standard deviation of the sampling distribution of the sample mean is equal to standard deviation of population, σ.
(E) According to Central Limit Theorem, the sampling distribution of the sample mean approaches to normal distribution regardless the true distribution of population.

18. What do we mean when we say that a simple linear regression model is "statistically" useful?
(A) All the statistics computed from the sample make sense.
(B) The model is an excellent predictor of Y.
(C) The model is one alternative predictor of Y.
(D) The model is "practically" useful for predicting Y.
(E) The model is a better predictor of Y than the sample mean.

19. If the correlation coefficient (r) = 1.00, then
(A) the Y-intercept (b_0) must equal 0.
(B) the estimated slope coefficient must equal 1.
(C) the explained variation equals the unexplained variation.
(D) there is no unexplained variation.
(E) there is no explained variation.

20. The sample correlation coefficient between X and Y is 0.375. It has been found out that the p-value is 0.256 when testing H_0: $\rho = 0$ against the two-sided alternative H_1: $\rho \neq 0$. To test H_0: $\rho = 0$ against the one-sided alternative H_1: $\rho < 0$ at a significance level of 0.2, the p-value is
(A) 0.256 / 2
(B) 0.256 × 2
(C) 1 – 0.256
(D) 1 – 0.256 × 2
(E) 1 – 0.256 / 2

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21. Given the following information, calculate the degrees of freedom that should be used in the pooled-variance t test.
$s_1^2 = 4 \quad n_1 = 16 \quad n_2 = 25 \quad s_2^2 = 6$
(A) $df = 41$
(B) $df = 39$
(C) $df = 25$
(D) $df = 16$
(E) $df = 9$

22. In a multiple regression model, which of the following is correct regarding the value of the adjusted-R^2?
(A) It can be negative.
(B) It has to be larger than the coefficient of multiple determination.
(C) It has to be greater than 0.
(D) It can be larger than 1.
(E) It can be larger than the conventional R^2.

23. Which of the following would be an appropriate alternative hypothesis?
(A) The mean of a population is equal to 55.
(B) The mean of a sample is equal to 55.
(C) The mean of a population is greater than 55.
(D) The mean of a sample is greater than 55.
(E) None of above.

24. If we are performing a two-tailed test of whether $\mu = 100$, the probability of detecting a shift of the mean to 105 will be _____ the probability of detecting a shift of the mean to 110.
(A) less than
(B) greater than
(C) equal to
(D) not comparable to
(E) twice as

25. If, as a result of a hypothesis test, we reject the null hypothesis when it is false, then we have committed
(A) a Type I error.
(B) a Type II error.
(C) a Type III error.
(D) no error.
(E) an acceptance error.

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二、計算題（50%）：

1. (8 points) Assume events A, B and C are mutually exclusive, and $P(A) = 0.3$, $P(B) = 0.5$ and $P(C) = 0.2$. Let $P(D|B) = 0.4$ and $P(D|A) = P(D|C) = 0.6$. Then $P(A|D) = ?$

2. (12 points) A research finds the average household income of 25 households in Taipei is \$60 thousands. It also knows the average household income for all Taiwanese households is \$57 thousands. The standard deviation of household income for all Taiwanese household is \$9 thousands. The goal of research is to determine whether the income level is higher in Taipei than the level of whole nation.
   (A) State appropriate hull and alternative hypotheses.
   (B) Find and interpret the p-value. What does it mean?
   (C) Would you reject or accept the null hypothesis at 95% confidence level? What's the main conclusion of this research?

3. (12 points) Suppose the probability density of X is $f(x) = \beta x^2(1 - x)^3$ for $0 < x < 1$.
   (A) Find β.
   (B) Find the probability $P(0.25 < X < 0.75)$.

4. (10 points) A researcher tries to find how many times of occupational switches a blue-collar worker has during his/her career. A previous study shows that the population mean was 5 with a variance of 2. The researcher collects a random sample as below from the population and tries to see if the mean stays the same as previous study. State appropriate hypotheses and test them at $\alpha = 1\%$.

   8, 9, 6, 5, 9, 8, 3, 5, 4, 3

5. (8 points) A labor economist likes to know how the wage rate affect hours worked for people. He has following 5 people's data as below. Find the correlation between the two variables. How does the correlation indicate level of relationship?

Wage per hour (\$)	14	15	13	18	10
Hours worked per week	32	34	31	39	34

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Standard Normal Distribution (*Z* Table)

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990