國立成功大學 105 學年度碩士班招生考試試題

系　　所：企業管理學系

考試科目：統計學

考試日期：0228，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

PART A　Choose the answer (60 points, 5 pts each)

1. A sample of 5 automobiles is shown in the following Table. Data show the size of the automobile (compact, midsize, or large), the number of cylinders in the engine, the city driving miles per gallon, the highway driving miles per gallon, and the recommended fuel (diesel, premium, or regular). Which of the following description is ***False***?

Car	Size	Cylinders	City MPG	Highway MPG	Fuel
Audi A8	Large	12	13	19	Premium
Ford Focus	Compact	4	24	33	Regular
BMW 328 Xi	Compact	6	17	25	Premium
Toyota Camry	Midsize	4	21	31	Regular
Volkswagen Jetta	Compact	5	21	29	Regular

a. Size and Fuel are categorical variables.
b. Cylinders, City MPG, and Highway MPG are quantitative variables.
c. The measurement scale of Size is Interval.
d. The measurement scale of Cylinders, City MPG, and Highway MPG are Ratio.
e. The measurement scale of Fuel is Nominal.

2. Which of the following description is ***False***?
a. Mean, Median, and Mode measure the location of a data set.
b. Percentiles and Quartiles measure the location of a data set.
c. Range, and Interquartile Range measure the location of a data set.
d. Variance and Standard Deviation measure the variability of a data set.
e. Coefficient of Variation indicates how large the standard deviation is relative to the mean

Using the following information to answer the **Questions 3 & 4**.
According to the report, 3.5% of all full-time Taiwan undergraduate students studied abroad during the 2012-2013 academic year. Assume that participation records show female take 60% of the students who studied abroad during the 2012-2013 academic year, but female take only 49% who didn't participate.
Let A_1 = the student studied abroad during the 2012-2013 academic year
A_2 = the student did not study abroad during the 2012-2013 academic year
W = the student is a female student
M= the student is a male student

3. Which statement is correct
a. $P(W|A_1) = 0.0425$
b. $P(W|A_2) = 0.9775$
c. $P(A_1|W) = 0.965$
d. $P(A_2|W) = 0.49$
e. $P(W) = 0.49385$

4. Which statement is correct
a. $P(A_1|M) = 0.97234$
b. $P(M|A_2) = 0.40$
c. $P(A_1 \cap M) = 0.49215$
d. $P(M) = 0.50615$
e. $P(M|A_2) = 0.49$

5. Consider a Poisson distribution with a mean of two occurrences per time period. Which of the following statement is incorrect?

a. The appropriate Poisson probability function is $\frac{2^x e^{-2}}{x!}$

b. The appropriate Poisson probability function to determine the probability of x occurrences in three time periods is $\frac{3^x e^{-3}}{x!}$

c. The probability of two occurrences in one time period is $\frac{2^2 e^{-2}}{2!}$

d. The probability of six occurrences in three time period is $\frac{6^6 e^{-6}}{6!}$

e. The probability of five occurrences in two time period is $\frac{4^5 e^{-4}}{5!}$

Using the following information to answer **Questions 6& 7.**
In an experiment, the scientists selected a sample of 65 objects from the local population of obese adults. From these, experimenters randomly assigned 35 to the Atkins diet and 30 to the conventional diet. Does this experiment show, with α=0.05, that the Atkins diet is worth the extra effort and produces 5 more pounds of weight loss? The summary of data is shown as the table.

Diet Program	Number of Samples	Mean	Standard Deviation
Atkins	35	15.00	12.00
Conventional	30	7.00	10.00

6. The most suitable hypothesis statement of this problem is

a. $H_0 : \mu_A - \mu_C \leq 5$ versus $H_1 : \mu_A - \mu_C > 5$

b. $H_0 : \mu_A - \mu_C = 5$ versus $H_1 : \mu_A - \mu_C \neq 5$

c. $H_0 : \mu_A - \mu_C \geq 5$ versus $H_1 : \mu_A - \mu_C < 5$

d. $H_0 : \mu_A - \mu_C \leq 0$ versus $H_1 : \mu_A - \mu_C > 0$

e. $H_0 : \mu_A - \mu_C = 0$ versus $H_1 : \mu_A - \mu_C \neq 0$

7. The two-sample t test is applied to test the null hypothesis, and the t-statistic is

a. 0 < t-statistic < 1
b. 1 < t-statistic < 2
c. 2 < t-statistic < 3
d. 3 < t-statistic < 4
e. 4 < t-statistic < 5

8. Identify the following mistakes as either Type I or Type II errors. Which statement is correct?

a. A jury convicts an innocent defendant : Type II error
b. A retailer fails to stock fashion items that become popular in the coming season : Type I error
c. A company hires an applicant who is not qualified for the position: Type II error
d. A diagnostic test fails to detect the presence of a serious virus infection: Type II error
e. None of the above statement is correct.

Using the following information to answer **Questions 9 & 10.**

The diameter of a metal shaft used in a disk-drive unit is normally distributed with mean 0.2508 inch and standard deviation 0.0005 inch. The specifications on the shaft have been established as 0.2500±0.0015 inch.

9. What fraction of the shafts produced that conform the specifications? (Please use the appendix table A.)
a. 80% to 85%
b. 85% to 90%
c. 90% to 95%
d. 95% to 98%
e. above 98%

10. Suppose that we can re-center the manufacturing process, perhaps by adjusting the machine, so that the process mean is exactly equal to the nominal value of 0.2500. Then, by re-centering the process, we may increase the yield of the process to approximately
a. 80% to 85%
b. 85% to 90%
c. 90% to 95%
d. 95% to 98%
e. above 98%

11. A bank operates both a drive-up facility and a walk-up window. On a randomly selected day, let X= the proportion of time that the drive-up facility is in use and Y= the proportion of time that the walk-up window is in use. Then the set of possible values for (X, Y) is the rectangle $D=\{(x, y): 0 \le x \le 1, 0 \le y \le 1\}$. Suppose the joint probability density function of (X, Y) is given by

$$f(x, y)=\begin{cases}\frac{6}{5}(x+y^2), & 0 \le x \le 1, 0 \le y \le 1 \\ 0, & \text{otherwise}\end{cases}$$

Thus, the probability that neither facility is busy more than one-quarter of the time is between which following interval?
a. [0, 0.01]
b. [0.01, 0.02]
c. [0.02, 0.03]
d. [0.03, 0.04]
e. [0.04, 0.05]

12. Consider the exponential probability density function as follows.

$$f(x)=\frac{1}{8}e^{-x/8} \quad \text{for } x \ge 0$$

Which of following statement is ***incorrect***? The following values may help you to find out the answers.
$e^{-0.125}=0.8825$, $e^{-0.25}=0.7788$, $e^{-0.5}=0.6065$, $e^{-0.75}=0.4724$, $e^{-0.8}=0.4493$,
$e^{-1}=0.3679$
a. $P(x \le 6)=0.5276$
b. $P(x \le 4)=0.3935$
c. $P(x \ge 2)=0.2212$
d. $P(1 \le x \le 6)=0.4101$
e. $P(x \ge 8)=$ 0.3679

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Part B　Calculation　(40 points)

1. [30 points]

Three different varieties of tomato (H, Ife, and P) and four different plant densities (10, 20, 30, and 40 thousand plants per hectare) are being considered for planting in a particular region. To see whether either variety or plant density affects yield, each combination of variety and plant density is used in three different plots, resulting in the data on yields in following table.

Variety (i)	Planting Density (j)					
	10	20	30	40	$x_{i..}$	$\bar{x}_{i..}$
H	10.5, 9.2, 7.9	12.8, 11.2, 13.3	12.1, 12.6, 14.0	10.8, 9.1, 12.5	136.0	11.33
Ife	8.1, 8.6, 10.1	12.7, 13.7, 11.5	14.4, 15.4, 13.7	11.3, 12.5, 14.5	146.5	12.21
P	16.1, 15.3, 17.5	16.6, 19.2, 18.5	20.8, 18.0, 21.0	18.4, 18.9, 17.2	217.5	18.13
$x_{.j.}$	103.3	129.5	142.0	125.2	500	
$\bar{x}_{.j.}$	11.48	14.39	15.78	13.91		13.89

(a) [6 points]

Please state the hypotheses to test two factors, variety, and planting density, and the interaction, respectively.

(b) [24 points]

Please complete the following ANOVA table. Show the details that how you get the numbers of column A, B, C, D, E, F, G, H, I, J, K, L, M, N, and O

ANOVA

Source of Variation	df	Sum of Squares	Mean Square	F
Varieties	A	F	I	M
Density	B	G	J	N
Interaction	C	8.03	K	O
Error	D	38.04	L	
Total	E	H		

The following information may help you to complete the ANOVA table:

$$\sum_i \sum_j \sum_k x_{ijk}^2 = 7404.80,\quad \frac{1}{36}x_{...}^2 = \frac{1}{36}\times 500^2 = 6944.44,\quad \frac{1}{12}\sum_i x_{i..}^2 = 7272.042,\quad \frac{1}{9}\sum_i x_{.j.}^2 = 7031.131.$$

2. [10 points]

Five observations taken for two variables follow.

x_i	4	6	11	3	16
y_i	50	50	40	60	30

(a) [5 points] Compute and interpret the sample covariance.

(b) [5 points] Compute and interpret the sample correlation coefficient.

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Appendix Table A

Standard Normal Probabilities

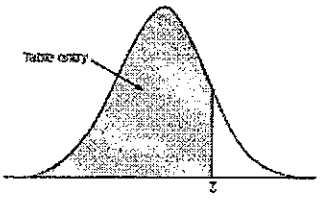

Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.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

[References]

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