

說明：本試題共有三大題。第一大題為單選題部分，考生應作答於『答案卡』，共有 20 題，每題 3 分，共計 60 分。第二及第三大題為問答題，每題 20 分，共 40 分。全部總計 100 分。

一、單選題，每題 3 分，共 20 題(請考生作答於『答案卡』)

1. ( ) A watchdog group is investigating how people are treated during the foreclosure process. Surveys were mailed to a random sample of 300 people who had recently been threatened with foreclosure. 75 of the surveys were returned by the postal service because the intended recipients had moved and left no forwarding address. What type of problem has occurred?
- (A) selection bias (B) social desirability bias  
(C) measurement error (D) nonresponse bias

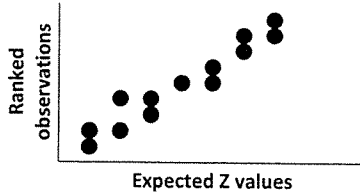
2. ( ) A survey was conducted to determine how people feel about the quality of programming available on television. Respondents were asked to rate the overall quality from 0 (no quality at all) to 100 (extremely good quality). The stem-and-leaf display of the data is shown below.

Stem	Leaf
3	2 9
4	0 3 4 7 8 9 9 9
5	0 1 1 2 3 4 5
6	1 2 5 6 6
7	1 9
8	
9	6

What percentage of the respondents rated overall television quality as very good (regarded as ratings of 70 and above)?

- (A) 1% (B) 4% (C) 12% (D) 24%
3. ( ) The following is a list of 25 measurements from a certain population:
- 12 18 14 17 19 16 14 18 15 17 11
- How many of the measurements fall within one standard deviation of the mean?
- (A) 8 (B) 9 (C) 10 (D) 11
4. ( ) At the U.S. Open Tennis Championship a statistician keeps track of every serve that a player hits during the tournament. The statistician reported that the mean serve speed of a particular player was 105 miles per hour (mph) and the standard deviation of the serve speeds was 14 mph. Assume that the statistician also gave us the information that the distribution of the serve speeds was mound-shaped and symmetric. What proportion of the player's serves was between 119 mph and 147 mph?
- (A) 0.1574 (B) 0.3172 (C) 0.9544 (D) 0.9973
5. ( ) If nothing is known about the shape of a distribution, what percentage of the observations fall within 2 standard deviations of the mean?
- (A) approximately 5% (B) at most 25%  
(C) approximately 95% (D) at least 75%
6. ( ) An exit poll during a recent election revealed that 52% of those voting were women and 48% were men. The results also showed that 70% of the women voting favored Democratic candidates while only 40% of the men favored Democratic candidates. Find  $P(\text{woman} | \text{favored Democrats})$
- (A) 0.028 (B) 0.655 (C) 0.712 (D) 0.824

7. ( ) Which one of the following suggests that the data set is not approximately normal?  
 (A) A data set with  $IQR = 752$  and  $s = 574$ .  
 (B) A data set with 68% of the measurements within  $\bar{x} \pm 2s$   
 (C) (D)



Stem	Leaves
3	0 3 9
4	2 4 7 7
5	1 3 4 8 8 9 9 9
6	0 0 5 6 6 7 8
7	1 1 5
8	2 7

8. ( ) The university police department must write, on average, five tickets per day to keep department revenues at budgeted levels. Suppose the number of tickets written per day follows a Poisson distribution with a mean of 7.5. Interpret the value of the mean.  
 (A) If we sampled all days, the arithmetic average number of tickets written would be 7.5 tickets per day.  
 (B) The number of tickets that is written most often is 7.5 tickets per day.  
 (C) On half of the days less than 7.5 tickets are written and on half of the days have more than 7.5 tickets are written.  
 (D) The mean has no interpretation since 7.5 tickets can never be written.
9. ( ) The probability that an individual is left-handed is 0.11. In a class of 40 students, what is the mean and standard deviation of the number of left-handed students?  
 (A) mean: 4.4; standard deviation: 2.10 (B) mean: 4.4; standard deviation: 1.98  
 (C) mean: 4.0; standard deviation: 1.98 (D) mean: 4.0; standard deviation: 2.10
10. ( ) The preventable monthly loss at a company has a normal distribution with a mean of \$6,100 and a standard deviation of \$30. A new policy was put into place, and the preventable loss the next month was \$5,920. What inference can you make about the new policy?  
 (A) While the probability that the monthly loss would be as low as \$5,920 is small, it is not unexpected.  
 (B) The new policy is probably less effective than the one it replaced.  
 (C) Because the probability that the monthly loss would be as low as \$5,920 is not very small, the new policy is not working.  
 (D) Because the probability that the monthly loss would be as low as \$5,920 is small, the new policy is working.
11. ( ) In constructing a confidence interval, how could we alter the sample size and the confidence coefficient in order to guarantee a decrease in the width of the interval?  
 (A) Decrease the sample size but increase the confidence coefficient.  
 (B) Keep the sample size the same but increase the confidence coefficient.  
 (C) Increase the sample size but decrease the confidence coefficient.  
 (D) Increase the sample size and increase the confidence coefficient.
12. ( ) The 95% confidence interval for the mean sale price of homes in a particular neighborhood was calculated to be (40,249.4, 52,750.6). A friend suggests that the mean sale price of homes in this neighborhood is \$51,000. Comment on your friend's suggestion.  
 (A) All you can say is that the mean sale price might be \$51,000.  
 (B) Your friend is correct, and you are 100% certain.  
 (C) Your friend is correct, and you are 98% certain.  
 (D) Your friend is wrong, and you are 98% certain.

13. ( ) A local men's clothing store is being sold. The buyers are trying to estimate the percentage of items that are outdated. They will choose a random sample from the 100,000 items in the store's inventory in order to determine the proportion of merchandise that is outdated. The current owners have never determined the percentage of outdated merchandise and cannot help the buyers. How large a sample do the buyers need in order to be 98% confident that the margin of error of their estimate is about 4%?  
(A) 365 (B) 846 (C) 1067 (D) 3394
14. ( ) Suppose we wish to test  $H_0: \mu \leq 25$  vs.  $H_1: \mu > 25$ . Which of the following possible sample results gives the most evidence to support  $H_1$ ?  
(A)  $\bar{X} = 27, s = 5$  (B)  $\bar{X} = 29, s = 10$   
(C)  $\bar{X} = 23, s = 2$  (D)  $\bar{X} = 28, s = 3$
15. ( ) A random sample of  $n$  observations, selected from a normal population, is used to test the null hypothesis  $H_0: \sigma^2 \geq 155$ . Specify the appropriate rejection region.  
Let  $n = 14, \alpha = .01$ .  
(A)  $s^2 < 48.97$  (B)  $s^2 < 55.67$  (C)  $s^2 < 65.31$  (D)  $s^2 < 78.29$
16. ( ) We sampled 100 men and 100 women and asked: "Do you think the environment is a major concern in 2015?" Of those sampled, 67 women and 53 men responded that they believed it is. For the confidence interval procedure for the test of  $H_0: P_1 - P_2 = 0$  to work properly, what additional assumptions must be satisfied?  
(A) The population variances are equal.  
(B) Both samples were randomly and independently selected from their respective populations.  
(C) Both populations have approximate normal distributions.  
(D) All of the above are necessary.
17. ( ) In a controlled laboratory environment, a random sample of 10 adults and a random sample of 10 children were tested by a psychologist to determine the room temperature that each person finds most comfortable. The data are summarized below:

	Sample Mean	Sample Variance
Adults (1)	77.5°F	4.5
Children (2)	74.5°F	2.5

Find the standard error of the estimate for the difference in mean comfortable room temperatures between adults and children, assuming  $\sigma_1^2 \neq \sigma_2^2$ .

- (A) 0.7000 (B) 0.1871 (C) 0.8367 (D) 1.6279

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18. ( ) An experiment was conducted to compare the mean iron content in iron ore pieces determined by three different methods: (1) mechanical, (2) manual, and (3) laser. Five 1-meter long pieces of iron ore were removed from a conveyor belt, and the iron content of each piece was determined using each of the three methods. The data are shown below. How should the data be analyzed?

Piece	Mechanical	Manual	Laser
1	60.49	61.52	60.46
2	65.59	66.09	66.61
3	60.47	60.53	61.81
4	58.49	58.52	58.36
5	53.35	52.37	54.31

- (A) randomized block design with three treatments and five blocks  
 (B) randomized block design with five treatments and three blocks  
 (C)  $3 \times 5$  factorial design  
 (D) completely randomized design with three treatments
19. ( ) A teacher finds that final grades in the statistics department are distributed as: A, 25%; B, 25%; C, 40%; D, 5%; F, 5%. At the end of a randomly selected semester, the following grades were recorded. Find the rejection region used to determine if the grade distribution for the department is different than expected. Use  $\alpha = 0.01$ .

Grade	A	B	C	D	E
Number	42	36	60	8	14

- (A)  $\chi^2 > 7.779$       (B)  $\chi^2 > 11.143$       (C)  $\chi^2 > 9.488$       (D)  $\chi^2 > 13.277$
20. ( ) Consider the interaction model  $E(y) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_1x_2$ . Which statement listed below is false?
- (A) The independent variables  $x_1$  and  $x_2$  interact when the effect on  $E(y)$  of a change in  $x_1$  depends on  $x_2$ .  
 (B) In an interaction model, the relationship between  $E(y)$  and  $x_1$  is linear for each fixed value of  $x_2$  but the slopes of the lines relating  $E(y)$  and  $x_1$  may be different for two different fixed values of  $x_2$ .  
 (C) Once interaction has been established between  $x_1$  and  $x_2$ , the first-order terms for  $x_1$  and  $x_2$  may be deleted from the regression model leaving the higher-order term containing the product of  $x_1$  and  $x_2$ .  
 (D) If both  $\beta_1$  and  $\beta_3$  are positive and significant, then the effect of  $x_1$  on  $E(y)$  would be increasing as  $x_2$  increases.

※ 注意：請於試卷上「非選擇題作答區」內依序作答，並應註明作答之大題及其題號。

二、設人事部門進行一項研究，探討該公司之員工的教育程度與性別對其工作滿足感的影響。茲以工作滿足感的測驗卷對公司的 20 名員工測試，其結果如下表每組五名，分數欲高表示工作滿足感越高。

	大學畢業	高中畢業
男	3, 0, 2, 1, 3	6, 5, 4, 3, 3
女	5, 4, 4, 2, 3	7, 6, 5, 6, 3

1. 若分析之部分結果如下：(5 分)

變異來源	平方和	自由度	均方	F 值
性別	12.800			
學歷	24.200			
性別*學歷	0.800			
誤差	26.400			
總和	64.200			

請在答案卷上重新列表，並將此 ANOVA 表完整的計算出來。

- 請列出在此種研究設計下，所有可能之研究假設。(5 分)
- 請根據 ANOVA 表之結果檢定上述之假設，設  $\alpha = 0.05$ 。(5 分)  
(註：  $F_{0.05,(1,16)} = 4.49$ ，  $F_{0.05,(2,16)} = 3.63$ )
- 請解釋你的分析結果。(5 分)

三、An analyst for a retail company has developed a formal linear regression model to predict the sales of 50 of their stores. The estimated model is

$$\hat{Y} = \beta_0 + \beta_1 X_1$$

where

$\hat{Y}$  = average monthly sales

$X$  = square foot area of store property

$X_1 = X - \bar{X}$  (difference from the mean)

After analyzing the data, the estimation results were

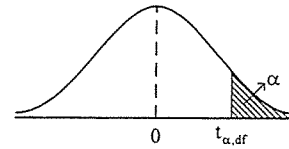
Variable	Mean	Range of Data	Est. Coefficient	t-value	$R^2$
Y		5,000-80,000 (in \$1,000)	$\beta_0=10,000$		
X	10,000	3,000-20,000 sq. ft.	$\beta_1=3.1$	2	0.3

- What does  $R^2$  mean? (5 分)
- Interpret the parameter estimates  $\beta_0$  and  $\beta_1$ . (5 分)
- Is the  $X_1$  variable significant? At what level? (5 分)
- A new store is proposed with 30,000 sq. ft. What would you predict sales to be? What assumptions underlie the estimate? (5 分)

見背面

t 分配臨界值表

$$P(t_{df} > t_{\alpha, df}) = \alpha$$

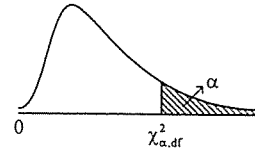


df	$\alpha$											
	0.25	0.20	0.15	0.10	0.05	0.025	0.02	0.01	0.005	0.0025	0.001	0.0005
1	1.000	1.376	1.963	3.078	6.314	12.710	15.890	31.820	63.660	127.30	318.30	636.60
2	0.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.090	22.330	31.600
3	0.765	0.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.210	12.920
4	0.741	0.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.678	0.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
$\infty$	0.674	0.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291

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卡方分配臨界值表

$$P(\chi_{df}^2 > \chi_{\alpha,df}^2) = \alpha$$



df	$\alpha$									
	0.995	0.990	0.975	0.950	0.900	0.100	0.050	0.025	0.010	0.005
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

試題隨卷繳回