

臺灣綜合大學系統 109 學年度學士班轉學生聯合招生考試試題

科目名稱	統計學	類組代碼	B11
		科目碼	B1192
※本項考試依簡章規定所有考科均「不可」使用計算機。		本科試題共計 5 頁	
Part I (60%, 4% for each question) Multiple choice (單選題). [本大題請於答案卡作答]			
1. What is the expected value of the sum of the faces when two fair dies are tossed? (A) 6, (B) 7, (C) 5, (D) 4, (E) 12.			
2. COVID-19 has an 85% pass-through rate if one stays close to a COVID-19 patient for 1 hour within 1 meter range. Suppose twenty people had contact with a COVID-19 patient for 1 hour within 1 meter range. What is the probability that exactly eighteen are infected? (A) $(.85)^{18}$, (B) 0, (C) $(.15)^2$, (D) $(.85)^{18} (.15)^2$, (E) none of the above.			
3. Suppose in a football team the weights of the football players follow a normal distribution, with mean at 75 kg and standard deviation of 15. If there are 39 players in this team, approximately how many players are with weights between 75 and 90 kg? (A) 5, (B) 21, (C) 8, (D) 13, (E) none of the above.			
4. In a large company, an experienced applicant has an 80% probability of getting a particular job. An inexperienced applicant has a 50% chance of getting the same job. In the past few years, 60% of the applicants are inexperienced. If the job was offered to an applicant, what is the closest probability that the applicant was inexperienced? (A) 0.4, (B) 0.7, (C) 0.3, (D) 0.6, (E) 0.5.			
5. Suppose the price of stock S1 is normally distributed over time with mean of 25 and a standard deviation of 3. If Tom buys stock S1 at \$25 and sells it on a randomly chosen day in the future, what is the approximate probability that Tom will make at least \$3 on S1? (A) 0.50, (B) 0.32, (C) 0.16, (D) 0.05, (E) none of the above.			
6. The width of a 95% confidence interval for the population mean is 40 units. The sample size is large (over 100). What would be the approximate width of a 90% confidence interval for the population mean, everything else (sample size, sample variance) are the same? (A) 20, (B) 24, (C) 28, (D) 32, (E) 36.			
7. In a regular statistical test, an increase in alpha, the level of significance, causes: (A) An increase in the probability of the type I error to occur. (B) A decrease in the probability of type I error to occur. (C) No change in any of the type I or type II error. (D) An increase in the probability of type II to occur. (E) None of the above.			

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8. A statistician would like to test the null hypothesis that the population mean is 50 versus the alternative that it is not 50. A random sample was collected with sample size 4. The sample mean is 38 with a sample standard deviation of 16. At $\alpha = 0.05$, the statistician should:

- (A) strongly reject the null hypothesis
- (B) mildly reject the null hypothesis
- (C) fail to reject the null hypothesis
- (D) accept the alternative hypothesis
- (E) there is insufficient information to determine

9. A 90% confidence interval can be interpreted as:

- (A) In 90% of the samples, the mean of the samples will be outside the interval.
- (B) There is a 10% chance that the true parameter value is outside the interval.
- (C) 90% of all population values are within the interval.
- (D) Both A) and B).
- (E) None of the above.

10. The telephone company CHT wants to estimate the mean number of minutes people in a city spend talking long distance, to within 5 minutes with 95% confidence. From past records, an estimate of the standard deviation is 16 minutes. What is the minimum sample size of a random sample?

- (A) 30, (B) 16, (C) 23, (D) 5, (E) None of the above.

11. When testing for the equality of two population proportions based on two independent random samples, the F distribution is:

- (A) sometimes appropriate.
- (B) never appropriate.
- (C) only appropriate if both sample sizes are less than 30.
- (D) only appropriate if at least one sample is at least 30.
- (E) used when the two variances are not equal.

12. Two population means are compared to determine if a difference exists by observing two independent random samples. The number in the first sample is 15 and the number in the second sample is 12. How many degrees of freedom are associated with the critical t-value?

- (A) 12, (B) 15, (C) 25, (D) 27, (E) None of the above.

背面有題，請繼續作答。

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13. How many degrees of freedom are there in the test statistic comparing five population means with each sample containing 50 observations using an ANOVA?

(A) 250, (B) 4, (C) 245, (D) 50, (E) None of the above.

14. Consider a multiple regression problem with 4 independent variables. When the null hypothesis, $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ is rejected, the interpretation should be:

(A) there is no linear relationship between y and any of the three independent variables.

(B) all three independent variables have a slope of zero.

(C) there is a regression relationship between y and at least one of the 3 variables.

(D) all three independent variables have equal slopes.

(E) there is a regression relationship between y and all three independent variables.

15. What is the difference between R^2 and the adjusted R^2 ?

(A) the adjusted R^2 always increases as more independent variables are added

(B) the adjusted R^2 is smaller in this case because the constant term is negative.

(C) the adjusted R^2 is always smaller than R^2 .

(D) the adjusted R^2 adjusts explanatory power by the degrees of freedom.

(E) the adjusted R^2 adjusts explanatory power by the standard error.

Part II (40%) [本大題請於答案卷作答]

(Show the formulas and the hand calculation of values. 必須列出手算過程和數值結果)

1. (25%) For 5 months, a coffee shop varied the price of a specific coffee to estimate its demand curve. The price (x in dollars) 20, 30, 40, 50, 60 are corresponding to the sale amount (y in hundreds) 10, 30, 60, 40, 10 in 5 months.

A) (5%) Find the least square line. Give the formula and hand calculation detail.

B) (5%) Suppose the sale amounts are independent and identical normal distributed. Test the slope of the line, $\alpha = .05$. What can you say by the test result to the relationship of x and y. The standard deviation of the slope estimator is about 0.13.

C) (5%) Find the coefficient of determination and interpret the value.

D) (5%) Find the coefficient of correlation and interpret the value.

E) (5%) What is your conclusion about the relationship of tire price and the sale amount based on the data you observed?

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2. (15%) Are all employees equally likely to have accidents? A study conducted to address these questions for a particular manufacturing company.

KIND OF ACCIDENT

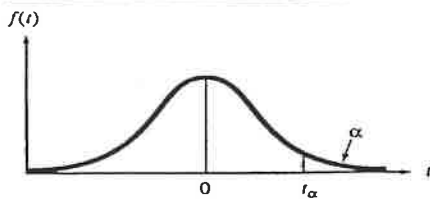
	Burn	cut
Age Under25	19	6
Age 25 and over	13	12

(A) (10%) Test if there is a relation between kind of accident and age at $\alpha=0.01$.

Explain what is the critical value you use.

(B) (5%) What assumptions do you need to ensure the test is valid?

TABLE VI Critical Values of t



ν	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	$t_{.001}$	$t_{.0005}$
1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Source: This table is reproduced with the kind permission of the Trustees of Biometrika from E. S. Pearson and H. O. Hartley (eds.), *The Biometrika Tables for Statisticians*, Vol. 1, 3d ed., Biometrika, 1966.

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TABLE VII Continued

Degrees of Freedom	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	2.70554	3.84146	5.02389	6.63490	7.87944
2	4.60517	5.99147	7.37776	9.21034	10.5966
3	6.25139	7.81473	9.34840	11.3449	12.8381
4	7.77944	9.48773	11.1433	13.2767	14.8602
5	9.23635	11.0705	12.8325	15.0863	16.7496
6	10.6446	12.5916	14.4494	16.8119	18.5476
7	12.0170	14.0671	16.0128	18.4753	20.2777
8	13.3616	15.5073	17.5346	20.0902	21.9550
9	14.6837	16.9190	19.0228	21.6660	23.5893
10	15.9871	18.3070	20.4831	23.2093	25.1882
11	17.2750	19.6751	21.9200	24.7250	26.7569
12	18.5494	21.0261	23.3367	26.2170	28.2995
13	19.8119	22.3621	24.7356	27.6883	29.8194
14	21.0642	23.6848	26.1190	29.1413	31.3193
15	22.3072	24.9958	27.4884	30.5779	32.8013
16	23.5418	26.2962	28.8454	31.9999	34.2672
17	24.7690	27.5871	30.1910	33.4087	35.7185
18	25.9894	28.8693	31.5264	34.8053	37.1564
19	27.2036	30.1435	32.8523	36.1908	38.5822
20	28.4120	31.4104	34.1696	37.5662	39.9968
21	29.6151	32.6705	35.4789	38.9321	41.4010
22	30.8133	33.9244	36.7807	40.2894	42.7956
23	32.0069	35.1725	38.0757	41.6384	44.1813
24	33.1963	36.4151	39.3641	42.9798	45.5585
25	34.3816	37.6525	40.6465	44.3141	46.9278
26	35.5631	38.8852	41.9232	45.6417	48.2899
27	36.7412	40.1133	43.1944	46.9630	49.6449
28	37.9159	41.3372	44.4607	48.2782	50.9933
29	39.0875	42.5569	45.7222	49.5879	52.3356
30	40.2560	43.7729	46.9792	50.8922	53.6720
40	51.8050	55.7585	59.3417	63.6907	66.7659
50	63.1671	67.5048	71.4202	76.1539	79.4900
60	74.3970	79.0819	83.2976	88.3794	91.9517
70	85.5271	90.5312	95.0231	100.425	104.215
80	96.5782	101.879	106.629	112.329	116.321
90	107.565	113.145	118.136	124.116	128.299
100	118.498	124.342	129.561	135.807	140.169