BP PM01

國立臺北科技大學 108 學年度碩士班招生考試

系所組別：4100 工業工程與管理系碩士班

第一節　統計學　試題

注意事項：

1. 本試題選擇題共 20 題，每題 3 分，計算題共 4 題，每題 10 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、單選題（共 60 分，每題 3 分）

1. If P(A) = 0.4, P(B | A) = 0.35, P(A∪B) = 0.69, then P(B) = (A) 0.14 (B) 0.43 (C) 0.75 (D) 0.59 .
2. In a box plot, data value x is considered an outlier if (A) x < Q1 – 1.0(IQR) or x > Q3 + 1.0(IQR) (B) x < Q2 – 1.0(IQR) or x > Q2 + 1.0(IQR) (C) x < Q1 – 1.5(IQR) or x > Q3 + 1.5(IQR) (D) x < Q2 – 1.5(IQR) or x > Q2 + 1.5(IQR) .
3. X is an exponentially distributed random variable with a mean of 4. The probability that x is between 2.48 and 5.56 is (A) 0.0000 (B) 0.4190 (C)0.2889 (D) 0.5222 .
4. The probability of randomly selecting 4 good quarts of milk in succession from a cooler containing 20 quarts of which 5 have spoiled is (A) 0.205 (B) 0.282 (C) 0.316 (D) 0.035 .
5. In order to test for the significance of a regression model involving 3 independent variables and 47 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of F are (A) 2 and 44 (B) 3 and 44 (C) 2 and 43 (D) 3 and 43 .
6. If s^2 represent the variances of independent random samples of size n = 25 taken from normal populations with variances $\sigma^2 = 5$, then $P(4 < s^2 < 7)$ = (A) 0.259 (B) 0.374 (C) 0.501 (D) 0.649 .
7. Scores on a recent national statistics exam were normally distributed with a mean of 76 and a standard deviation of 12. What is the probability that a randomly selected exam will have a score of at least 71? (A) 0.3385 (B) 0.6615 (C) 0.8176 (D) 0.9332
8. If $P(\chi^2_\alpha < X^2 < 23.209) = 0.015$ for a chi-squared distribution with degree of freedom $\upsilon = 10$, the χ^2_α is (A) 20.483 (B) 12.549 (C) 38.932 (D) 3.247 .
9. A life insurance company has determined airport, according to a Poisson process, that each week an average of seven claims is filed in its Nashville branch. What is the probability that during the next week fewer than four claims will be filed? (A) 0.0241 (B) 0.0817 (C) 0.1126 (D) 0.0009
10. In a regression analysis, the regression equation is given by y = 12 - 6x. If SSE = 510 and SST = 1000, then the coefficient of correlation is (A) -0.7 (B) 0.7 (C) 0.49 (D) -0.49 .
11. In order to determine whether or not the means of two populations are equal, (A) a t test must be performed. (B) an analysis of variance must be performed. (C) either a t test or an analysis of variance can be performed. (D) a chi-square test can be performed.
12. When individuals in a sample of 150 were asked whether or not they supported capital punishment, the following information was obtained. The result shows: Yes (40), No (60), No Opinion (50). We are interested in determining whether or not the opinions of the individuals (as to Yes, No, and No Opinion) are uniformly distributed. The p-value is (A) between 0.01 and 0.05 (B) between 0.05 and 0.1 (C) less than 0.01 (D) larger than 0.1 .
13. Computer technology has produced an environment in which robots operate with the use of microprocessors. The probability that a robot fails during any 6-hour shift is 0.10. What is the probability that a robot will operate through at most 5 shifts before it fails? (A) 0.4686 (B) 0.059 (C) 0.0656 (D) 0.4095
14. Five independent random samples are drawn from a same population of Gamma distribution. What probability distribution should be used to construct the confident interval of such sample mean? (A) Gamma (B) Normal (C) t (D) F distribution.
15. From a population with a variance of 900, a sample of 225 items is selected. At 95% confidence, the margin of error is (A) 15 (B) 2.0 (C) 3.92 (D) 4 .
16. If X_1 and X_2 are independent random variables with $X_1 \sim \chi^2_{v=3}$ and $X_2 \sim \chi^2_{v=5}$, then the random variable $Y = X_1 + X_2$ has an variance σ^2 equals to (A) 2 (B) 4 (C) 8 (D) 16 .
17. If the null hypothesis is not rejected at the 5% level of significance, it (A) will also not be rejected at the 1% level (B) will always be rejected at the 1% level (C) will sometimes be rejected at the 1% level (D) may be rejected or not rejected at the 1% level.
18. In an analysis of variance problem involving 3 treatments and 10 observations per treatment, SSE = 399.6. The MSE for this situation is (A) 13.78 (B) 13.32 (C) 14.8 (D) 30.0 .
19. If random variable $X_1 \sim \chi^2_{v=3}$ and $X_2 \sim$ Gamma(α=3, β=2), let $Y = X_1 + X_2$, then Y~ (A) Gamma(α=6, β=2) (B) Gamma(α=9/2, β=2) (C) $\chi^2_{v=6}$ (D) $\chi^2_{v=9/2}$
20. An important application of the chi-square distribution is (A) making inferences about a single population variance (B) testing for goodness of fit (C) testing for the independence of two categorical variables (D) All of these alternatives are correct.

注意：背面尚有試題

二、計算題（共 40 分，每題 10 分）

1. A system consists of five identical components connected in series as shown:

As soon as one component fails, the entire system will fail. Suppose each component has a lifetime that is exponentially distributed with λ=0.01 and that components fail independently of one another. Let X= the time (in hour) at which the system fails — that is, the shortest (minimum) lifetime among the five components.

(A)What is the probability P(X > 100)? (5 分)

(B)What is the probability the system will work between 50 to 100 hours? (5 分)

2. A continuous random variable X has the density function $f(x) = \begin{cases} e^{-x}, & x > 0 \\ 0, & elsewhere \end{cases}$ and

$Y = e^{2X/3}$

(A) Find the expected value of Y (5分)

(B) Find the probability distribution of Y (5分)

3. An university professor polled a dozen colleagues about the number of professional meetings they attended in the past five years (x) and the number of papers they submitted to refereed journals (y) during the same period. The summary data are given as follows:

$$n = 12, \quad \bar{x} = 4, \quad \bar{y} = 12,$$

$$\sum_{i=1}^{n} x_i^2 = 232, \quad \sum_{i=1}^{n} x_i y_i = 318.$$

(A) Fit a simple linear regression model between x and y. (7 分)

(B) Comment on whether attending more professional meetings would result in publishing more papers. (3 分)

4. (A) Compute 95% confidence intervals for the proportion of defective items in a process when it is found that a sample of size 100 yields 8 defectives. (4分)

(B) How large a sample is needed if we wish to be 98% confident that our sample proportion will be within 0.05 of the true proportion defective? (3分)

(C) No matter what the real defect proportion is, what is the largest sample size that guarantees the 98% confident margin error will less than 0.05? (3分)

Table A.3 (continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.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
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

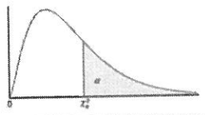

Table A.5 Critical Values of the Chi-Squared Distribution

v	α = 0.995	0.99	0.98	0.975	0.95	0.90	0.80	0.75	0.70	0.50
1	0.0^4393	0.0^3157	0.0^3628	0.0^3982	0.00393	0.0158	0.0642	0.102	0.148	0.455
2	0.0100	0.0201	0.0404	0.0506	0.103	0.211	0.446	0.575	0.713	1.386
3	0.0717	0.115	0.185	0.216	0.352	0.584	1.005	1.213	1.424	2.366
4	0.207	0.297	0.429	0.484	0.711	1.064	1.649	1.923	2.195	3.357
5	0.412	0.554	0.752	0.831	1.145	1.610	2.343	2.675	3.000	4.351
6	0.676	0.872	1.134	1.237	1.635	2.204	3.070	3.455	3.828	5.348
7	0.989	1.239	1.564	1.690	2.167	2.833	3.822	4.255	4.671	6.346
8	1.344	1.647	2.032	2.180	2.733	3.490	4.594	5.071	5.527	7.344
9	1.735	2.088	2.532	2.700	3.325	4.168	5.380	5.899	6.393	8.343
10	2.156	2.558	3.059	3.247	3.940	4.865	6.179	6.737	7.267	9.342
11	2.603	3.053	3.609	3.816	4.575	5.578	6.989	7.584	8.148	10.341
12	3.074	3.571	4.178	4.404	5.226	6.304	7.807	8.438	9.034	11.340
13	3.565	4.107	4.765	5.009	5.892	7.041	8.634	9.299	9.926	12.340
14	4.075	4.660	5.368	5.629	6.571	7.790	9.467	10.165	10.821	13.339
15	4.601	5.229	5.985	6.262	7.261	8.547	10.307	11.037	11.721	14.339
16	5.142	5.812	6.614	6.908	7.962	9.312	11.152	11.912	12.624	15.338
17	5.697	6.408	7.255	7.564	8.672	10.085	12.002	12.792	13.531	16.338
18	6.265	7.015	7.906	8.231	9.390	10.865	12.857	13.675	14.440	17.338
19	6.844	7.633	8.567	8.907	10.117	11.651	13.716	14.562	15.352	18.338
20	7.434	8.260	9.237	9.591	10.851	12.443	14.578	15.452	16.266	19.337
21	8.034	8.897	9.915	10.283	11.591	13.240	15.445	16.344	17.182	20.337
22	8.643	9.542	10.600	10.982	12.338	14.041	16.314	17.240	18.101	21.337
23	9.260	10.196	11.293	11.689	13.091	14.848	17.187	18.137	19.021	22.337
24	9.886	10.856	11.992	12.401	13.848	15.659	18.062	19.037	19.943	23.337
25	10.520	11.524	12.697	13.120	14.611	16.473	18.940	19.939	20.867	24.337
26	11.160	12.198	13.409	13.844	15.379	17.292	19.820	20.843	21.792	25.336
27	11.808	12.878	14.125	14.573	16.151	18.114	20.703	21.749	22.719	26.336
28	12.461	13.565	14.847	15.308	16.928	18.939	21.588	22.657	23.647	27.336
29	13.121	14.256	15.574	16.047	17.708	19.768	22.475	23.567	24.577	28.336
30	13.787	14.953	16.306	16.791	18.493	20.599	23.364	24.478	25.508	29.336
40	20.707	22.164	23.838	24.433	26.509	29.051	32.345	33.66	34.872	39.335
50	27.991	29.707	31.664	32.357	34.764	37.689	41.449	42.942	44.313	49.335
60	35.534	37.485	39.699	40.482	43.188	46.459	50.641	52.294	53.809	59.335

v	α = 0.30	0.25	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.001
1	1.074	1.323	1.642	2.706	3.841	5.024	5.412	6.635	7.879	10.827
2	2.408	2.773	3.219	4.605	5.991	7.378	7.824	9.210	10.597	13.815
3	3.665	4.108	4.642	6.251	7.815	9.348	9.837	11.345	12.838	16.266
4	4.878	5.385	5.989	7.779	9.488	11.143	11.668	13.277	14.860	18.466
5	6.064	6.626	7.289	9.236	11.070	12.832	13.388	15.086	16.750	20.515
6	7.231	7.841	8.558	10.645	12.592	14.449	15.033	16.812	18.548	22.457
7	8.383	9.037	9.803	12.017	14.067	16.013	16.622	18.475	20.278	24.321
8	9.524	10.219	11.030	13.362	15.507	17.535	18.168	20.090	21.955	26.124
9	10.656	11.389	12.242	14.684	16.919	19.023	19.679	21.666	23.589	27.877
10	11.781	12.549	13.442	15.987	18.307	20.483	21.161	23.209	25.188	29.588
11	12.899	13.701	14.631	17.275	19.675	21.920	22.618	24.725	26.757	31.264
12	14.011	14.845	15.812	18.549	21.026	23.337	24.054	26.217	28.300	32.909
13	15.119	15.984	16.985	19.812	22.362	24.736	25.471	27.688	29.819	34.527
14	16.222	17.117	18.151	21.064	23.685	26.119	26.873	29.141	31.319	36.124
15	17.322	18.245	19.311	22.307	24.996	27.488	28.259	30.578	32.801	37.698
16	18.418	19.369	20.465	23.542	26.296	28.845	29.633	32.000	34.267	39.252
17	19.511	20.489	21.615	24.769	27.587	30.191	30.995	33.409	35.718	40.791
18	20.601	21.605	22.760	25.989	28.869	31.526	32.346	34.805	37.156	42.312
19	21.689	22.718	23.900	27.204	30.144	32.852	33.687	36.191	38.582	43.819
20	22.775	23.828	25.038	28.412	31.410	34.170	35.020	37.566	39.997	45.314
21	23.858	24.935	26.171	29.615	32.671	35.479	36.343	38.932	41.401	46.796
22	24.939	26.039	27.301	30.813	33.924	36.781	37.659	40.289	42.796	48.268
23	26.018	27.141	28.429	32.007	35.172	38.076	38.968	41.638	44.181	49.728
24	27.096	28.241	29.553	33.196	36.415	39.364	40.270	42.980	45.558	51.179
25	28.172	29.339	30.675	34.382	37.652	40.646	41.566	44.314	46.928	52.619
26	29.246	30.435	31.795	35.563	38.885	41.923	42.856	45.642	48.290	54.051
27	30.319	31.528	32.912	36.741	40.113	43.195	44.140	46.963	49.645	55.475
28	31.391	32.620	34.027	37.916	41.337	44.461	45.419	48.278	50.994	56.892
29	32.461	33.711	35.139	39.087	42.557	45.722	46.693	49.588	52.335	58.301
30	33.530	34.800	36.250	40.256	43.773	46.979	47.962	50.892	53.672	59.702
40	44.165	45.616	47.269	51.805	55.758	59.342	60.436	63.691	66.766	73.403
50	54.723	56.334	58.164	63.167	67.505	71.420	72.613	76.154	79.490	86.660
60	65.226	66.981	68.972	74.397	79.082	83.298	84.58	88.379	91.952	99.608