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淡江大學 102 學年度碩士班招生考試試題

系別：保險系、企管系、運管系、管科系　　科目：統計學

考試日期：3 月 10 日(星期日) 第 2 節　　本試題共 3 大題， 4 頁 共1

本試題雙面印刷

I. Fill in the Cells (25 points)

1. The Tchebysheff's Theorem states that at most _____ of the measurements will lie outside the interval $(\mu-2\sigma, \mu+2\sigma)$, where μ and σ are the population mean and standard deviation, respectively.
2. If X has a binominal distribution, $X \sim B(n=5, p)$, then $\sum_{x=1}^{5}\binom{5}{x}p^x(1-p)^{5-x} =$ _____.
3. If X has a Poisson distribution with mean $\lambda=3$, then the standard deviation of X is _____.
4. Let X and Y be two independent normal distribution variables, $X \sim N(\mu_x=1, \sigma^2_x=2)$ and $Y \sim N(\mu_y=1, \sigma^2_y=1)$. Then the probability distribution of X-Y is _____.
5. If X is a standard normal distribution variable, then the probability distribution of X^2 is _____.

II. True/False Items (20 points)

1. Two events are mutually independent if, when one event occurs, the other cannot, and vice versa.
2. The empty set is not an element in the sample space.
3. The Central Limit Theorem states that, under rather general conditions, sums and means of random samples of measurements drawn from a population tend to have an approximately normal distribution.
4. When the sample size grows, the length of confidence interval for the population mean is shorter.
5. The significant level in a hypothesis testing is equivalent to the p-value.

III. (55 points)

1. Suppose that $P(A)=0.3$ and $P(B)=0.2$. If events A and B are independent, find the probability of $P(A \cup B)$. (5 points)
2. Two independent random samples are selected from each of two normal populations and given as follows:

Population 1 (X)	12	3	8	5	
Population 2 (Y)	13	8	6	5	5

(a) Test $H_0 : \sigma_1^2/\sigma_2^2 = 1$ vs. $H_1 : \sigma_1^2/\sigma_2^2 \neq 1$ using an F test at significant level $\alpha=0.1$. (15 points)

(b) Based on your conclusion in (a), find a 90% confidence interval for the difference between the two population means. (15 points)

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3. Find the least-square line for the data:

Response variable	4	3	1	0.5	0
Independent variable	-3	-3	0	3	3

(10 points)

4. Suppose that a response can fall into one of 3 categories with probabilities $p_1=p_2=p_3=1/3$, and $n=300$ responses produce these category counts:

Category	1	2	3
Observed Counts	110	98	92

Do the data provide sufficient evidence to indicate that the cell probabilities are different from those specified for the 3 categories? Find the approximate p-value and use it to make your decision. (10 points)

IV. Probability tables

i. Areas under the normal curve: $P(Z<z_\alpha)=\alpha$

z_α	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5	0.504	0.508	0.512	0.516	0.52	0.524	0.528	0.532	0.536
0.1	0.54	0.544	0.548	0.552	0.556	0.56	0.564	0.567	0.571	0.575
0.2	0.579	0.583	0.587	0.591	0.595	0.599	0.603	0.606	0.61	0.614
0.3	0.618	0.622	0.626	0.629	0.633	0.637	0.641	0.644	0.648	0.652
0.4	0.655	0.659	0.663	0.666	0.67	0.674	0.677	0.681	0.684	0.688
0.5	0.691	0.695	0.698	0.702	0.705	0.709	0.712	0.716	0.719	0.722
0.6	0.726	0.729	0.732	0.736	0.739	0.742	0.745	0.749	0.752	0.755
0.7	0.758	0.761	0.764	0.767	0.77	0.773	0.776	0.779	0.782	0.785
0.8	0.788	0.791	0.794	0.797	0.8	0.802	0.805	0.808	0.811	0.813
0.9	0.816	0.819	0.821	0.824	0.826	0.829	0.831	0.834	0.836	0.839
1.0	0.841	0.844	0.846	0.848	0.851	0.853	0.855	0.858	0.86	0.862
1.1	0.864	0.867	0.869	0.871	0.873	0.875	0.877	0.879	0.881	0.883
1.2	0.885	0.887	0.889	0.891	0.893	0.894	0.896	0.898	0.9	0.901
1.3	0.903	0.905	0.907	0.908	0.91	0.911	0.913	0.915	0.916	0.918
1.4	0.919	0.921	0.922	0.924	0.925	0.926	0.928	0.929	0.931	0.932
1.5	0.933	0.934	0.936	0.937	0.938	0.939	0.941	0.942	0.943	0.944
1.6	0.945	0.946	0.947	0.948	0.949	0.951	0.952	0.953	0.954	0.954
1.7	0.955	0.956	0.957	0.958	0.959	0.96	0.961	0.962	0.962	0.963
1.8	0.964	0.965	0.966	0.966	0.967	0.968	0.969	0.969	0.97	0.971
1.9	0.971	0.972	0.973	0.973	0.974	0.974	0.975	0.976	0.976	0.977
2.0	0.977	0.978	0.978	0.979	0.979	0.98	0.98	0.981	0.981	0.982

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ii. Critical value of student's t distribution: $P(T>t_{\alpha, df})=\alpha$

df \ α	0.25	0.1	0.05	0.025	0.01	0.00833	0.00625	0.005
1	1	3.078	6.314	12.706	31.821	38.204	50.923	63.657
2	0.816	1.886	2.92	4.303	6.965	7.65	8.86	9.925
3	0.765	1.638	2.353	3.182	4.541	4.857	5.392	5.841
4	0.741	1.533	2.132	2.776	3.747	3.961	4.315	4.604
5	0.727	1.476	2.015	2.571	3.365	3.534	3.81	4.032
6	0.718	1.44	1.943	2.447	3.143	3.288	3.521	3.707
7	0.711	1.415	1.895	2.365	2.998	3.128	3.335	3.499
8	0.706	1.397	1.86	2.306	2.896	3.016	3.206	3.355
9	0.703	1.383	1.833	2.262	2.821	2.934	3.111	3.25
10	0.7	1.372	1.812	2.228	2.764	2.87	3.038	3.169
11	0.697	1.363	1.796	2.201	2.718	2.82	2.981	3.106
12	0.695	1.356	1.782	2.179	2.681	2.78	2.934	3.055
13	0.694	1.35	1.771	2.16	2.65	2.746	2.896	3.012
14	0.692	1.345	1.761	2.145	2.624	2.718	2.864	2.977
15	0.691	1.341	1.753	2.131	2.602	2.694	2.837	2.947
16	0.69	1.337	1.746	2.12	2.583	2.673	2.813	2.921
17	0.689	1.333	1.74	2.11	2.567	2.655	2.793	2.898
18	0.688	1.33	1.734	2.101	2.552	2.639	2.775	2.878
19	0.688	1.328	1.729	2.093	2.539	2.625	2.759	2.861
20	0.687	1.325	1.725	2.086	2.528	2.613	2.744	2.845

iii. Critical values of Chi-square distribution: $P(\chi^2>\chi^2_{\alpha, df})=\alpha$

df \ α	0.99	0.975	0.95	0.9	0.5	0.1	0.05	0.025	0.01
1	0	0	0	0.02	0.45	2.71	3.84	5.02	6.63
2	0.02	0.05	0.1	0.21	1.39	4.61	5.99	7.38	9.21
3	0.11	0.22	0.35	0.58	2.37	6.25	7.81	9.35	11.34
4	0.3	0.48	0.71	1.06	3.36	7.78	9.49	11.14	13.28
5	0.55	0.83	1.15	1.61	4.35	9.24	11.07	12.83	15.09
6	0.87	1.24	1.64	2.2	5.35	10.64	12.59	14.45	16.81
7	1.24	1.69	2.17	2.83	6.35	12.02	14.07	16.01	18.48
8	1.65	2.18	2.73	3.49	7.34	13.36	15.51	17.53	20.09
9	2.09	2.7	3.33	4.17	8.34	14.68	16.92	19.02	21.67
10	2.56	3.25	3.94	4.87	9.34	15.99	18.31	20.48	23.21

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iv. Percentage points of the F distribution: $P(F>F_{0.05, v1, v2})=0.05$

v_2 \ v_1	1	2	3	4	5	6	7	8	9	10	12	15
1	161.45	199.5	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95
2	18.51	19	19.16	19.25	19.3	19.33	19.35	19.37	19.38	19.4	19.41	19.43
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.7
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6	5.96	5.91	5.86
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.1	4.06	4	3.94
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51
8	5.32	4.46	4.07	3.84	3.69	3.58	3.5	3.44	3.39	3.35	3.28	3.22
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01
10	4.96	4.1	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85
11	4.84	3.98	3.59	3.36	3.2	3.09	3.01	2.95	2.9	2.85	2.79	2.72
12	4.75	3.89	3.49	3.26	3.11	3	2.91	2.85	2.8	2.75	2.69	2.62
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.6	2.53
14	4.6	3.74	3.34	3.11	2.96	2.85	2.76	2.7	2.65	2.6	2.53	2.46
15	4.54	3.68	3.29	3.06	2.9	2.79	2.71	2.64	2.59	2.54	2.48	2.4