

八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：管理技術研究所

學程別：工業管理學程

組別：

科目：統計學

1. (15%) Let X be a continuous random variable with density

$$f(x) = cx^2 \quad -3 \leq x \leq 3$$

(a) Assuming that $f(x) = 0$ elsewhere, find the value of c that makes this a density.(b) Find $E[X]$ and $E[X^2]$ from the definitions of these terms.(c) Find $\text{Var } X$ and σ .(d) Find $P[X \leq 2]$; $P[-1 \leq X \leq 2]$; $P[X > 1]$ by direct integration.(e) Find the closed form expression for the cumulative distribution function F .

2. (20%)

(a) Find the moment generating function for a binomial random variable with parameters n and p .(b) Use $m_X(t)$ to show that $E[X] = np$.(c) Use $m_X(t)$ to show that $E[X^2] = n^2 p^2 - np^2 + np$.(d) Show that $\text{Var } X = npq$ where $q = 1 - p$.

3. (15%)

A chemical engineer is in charge of a particular process at an oil refinery. Past experience indicates that 10% of all shutdowns are due to equipment failure *alone*, 5% are due to a combination of equipment failure and operator error, and 40% involve operator error. A shutdown occurs. Find the probability that

(a) equipment failure or operator error is involved

(b) operator error alone is involved

(c) neither operator error nor equipment failure is involved

(d) operator error is involved given that equipment failure occurs

(e) operator error is involved given that equipment failure does not occur

4. (15%)

A vote is to be taken among the residents of a town and the surrounding county to determine whether a proposed chemical plant should be constructed. The construction site is within the town limits and for this reason many voters in the county feel that the proposal will pass because of the large proportion of town voters who favor the construction. To determine if there is a significant difference in the proportion of town voters and county voters favoring the proposal, a poll is taken. If 120 of 200 town voters favor the proposal and 240 of 500 county residents favor it, would you agree that the proportion of town voters favoring the proposal is higher than the proportion of county voters? Use a 0.025 level of significance.



(命題用紙)

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5. (15%) The television picture tubes of manufacturer A have a mean lifetime of 6.5 years and a standard deviation of 0.9 year, while those of manufacturer B have a mean lifetime of 6.0 years and a standard deviation of 0.8 year. What is the probability that a random sample of 36 tubes from manufacturer A will have a mean lifetime that is at least 1 year more than the mean lifetime of a sample of 49 tubes from manufacturer B?

6. (20%) The PJH&D Company is in the process of deciding whether or not to purchase a maintenance contract for its new word-processing system. They feel that maintenance expense should be related to usage and have collected the following information on weekly usage (hours) and annual maintenance expense.

Weekly Usage (hours)	Annual Maintenance Expense (\$100s)
13	17.0
10	22.0
20	30.0
28	37.0
32	47.0
17	30.5
24	32.5
31	39.0
40	51.5
38	40.0

- Develop the estimated regression line that relates annual maintenance expense, in hundreds of dollars, to weekly usage.
- Test the significance of the relationship in (a) at the $\alpha = .05$ level of significance.
- PJH&D expects to operate the word processor 30 hours per week. Develop a 95% prediction interval for the company's annual maintenance expense.
- If the maintenance contract costs \$3000 per year, would you recommend purchasing it? Why or why not?



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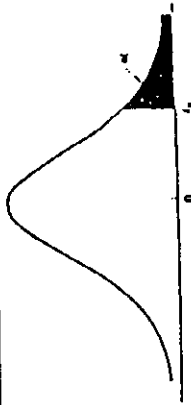
八十三學年度國立台灣工業技術學院研究所碩士班招生考試

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Student t Distribution



The following table provides the values of t_z that correspond to a given upper-tail area z and a specified number of degrees of freedom.

Degrees of Freedom	.4	.25	.1	.05	.025	.01	.005	.0025	.001	.0005
1	0.325	1.000	3.078	4.314	12.706	31.821	63.657	127.32	318.31	636.62
2	.289	.816	1.856	2.950	4.303	6.943	9.925	14.089	32.839	68.289
3	.277	.765	1.638	2.353	3.182	4.541	5.841	7.453	10.214	12.924
4	.271	.741	1.533	2.132	2.776	3.747	4.804	5.598	7.173	8.610
5	.267	.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.849
6	.265	.718	1.440	1.943	2.447	3.143	3.707	4.337	5.208	5.958
7	.263	.711	1.415	1.915	2.365	2.993	3.499	4.029	4.785	5.408
8	.262	.706	1.397	1.890	2.306	2.896	3.355	3.933	4.501	5.041
9	.261	.703	1.383	1.873	2.282	2.821	3.290	3.890	4.297	4.781
10	.260	.700	1.372	1.861	2.262	2.784	3.269	3.861	4.254	4.737
11	.260	.697	1.363	1.852	2.250	2.758	3.247	3.839	4.218	4.700
12	.259	.695	1.356	1.845	2.239	2.732	3.225	3.817	4.182	4.663
13	.259	.694	1.350	1.839	2.230	2.710	3.203	3.795	4.154	4.635
14	.258	.692	1.345	1.834	2.223	2.691	3.182	3.773	4.127	4.607
15	.258	.691	1.341	1.831	2.217	2.683	3.171	3.762	4.113	4.593
16	.258	.690	1.337	1.828	2.212	2.676	3.161	3.752	4.100	4.580
17	.257	.689	1.333	1.825	2.208	2.670	3.151	3.742	4.087	4.567
18	.257	.688	1.330	1.823	2.204	2.665	3.142	3.732	4.075	4.555
19	.257	.687	1.327	1.821	2.200	2.660	3.133	3.722	4.063	4.543
20	.257	.687	1.325	1.819	2.197	2.656	3.125	3.713	4.052	4.532
21	.257	.686	1.323	1.817	2.194	2.652	3.117	3.704	4.041	4.521
22	.256	.685	1.321	1.815	2.191	2.648	3.109	3.695	4.030	4.510
23	.256	.684	1.319	1.813	2.188	2.644	3.101	3.686	4.019	4.500
24	.256	.684	1.318	1.811	2.186	2.641	3.093	3.677	4.008	4.489
25	.256	.684	1.316	1.809	2.184	2.638	3.085	3.668	4.000	4.479
26	.256	.684	1.315	1.808	2.182	2.636	3.077	3.659	3.991	4.469
27	.256	.684	1.314	1.807	2.181	2.634	3.069	3.650	3.982	4.459
28	.256	.683	1.313	1.806	2.180	2.632	3.061	3.641	3.973	4.449
29	.256	.683	1.311	1.804	2.178	2.629	3.053	3.632	3.964	4.439
30	.256	.683	1.310	1.803	2.177	2.627	3.045	3.623	3.955	4.429
40	.255	.681	1.306	1.800	2.172	2.621	3.037	3.615	3.946	4.420
60	.254	.679	1.299	1.796	2.165	2.614	3.029	3.607	3.937	4.411
120	.253	.677	1.291	1.788	2.158	2.607	3.021	3.599	3.928	4.402
∞	.253	.674	1.282	1.783	2.149	2.599	3.012	3.590	3.919	4.393

Areas Under the Standard Normal Curve



The following table provides the area between the mean and normal deviate value z .

Normal Deviate z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3483	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4451	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4903	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4923	.4925	.4927	.4929	.4931	.4932	.4934
2.5	.4936	.4938	.4939	.4941	.4942	.4943	.4944	.4945	.4946	.4947
2.6	.4948	.4949	.4950	.4951	.4952	.4953	.4954	.4955	.4956	.4957
2.7	.4958	.4959	.4960	.4961	.4962	.4963	.4964	.4965	.4966	.4967
2.8	.4968	.4969	.4970	.4971	.4972	.4973	.4974	.4975	.4976	.4977
2.9	.4978	.4979	.4980	.4981	.4982	.4983	.4984	.4985	.4986	.4987
3.0	.4988	.4989	.4990	.4991	.4992	.4993	.4994	.4995	.4996	.4997
4.0	.4998	.4999	.5000	.5001	.5002	.5003	.5004	.5005	.5006	.5007

