國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：工業管理系碩士班　　組別：甲、乙、丙、丁組　　科目：統計學

共 6 題，答題時請顯示計算過程，只寫答案，不能獲得所有配分

1. 10%

Suppose X and Y are independent, each uniform on the unit interval (0, 1). Find the p.d.f. of their sum.

2. 20%

A certain type of unit has an exponential time to failure, with mean two hours. Find the probability

(a) that one unit lasts at least 4 hours.

(b) that at least one of a pair of units operating independently lasts four hours—that is, that $Y \geq 4$, where Y is the longer of two lifetimes.

(c) $E(Y)$, with Y as in (b).

(d) $E(W)$, where W is the first failure in the pair in (b).

3. 10%

Let X have the p.d.f. $f(x) = \frac{1}{2}e^{-|x|}$. Find

(a) $P(|X| > 1)$.　　(b) $P(X > 1 \,|\, |X| > 1)$.

4. 10%

A bowl contains five white and three black chips. Two chips are selected at random, one at a time. Find the probability that the first is black, given that the second is white,

(a) If there is replacement and mixing after the first selection.

(b) If there is no replacement.

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：工業管理系碩士班　　組別：甲、乙、丙、丁組　　科目：統計學

5. 30% A plant produces sulfur bricks that are used for structures in high-stress industrial environments. The production process is currently molding bricks with a mean weight of $\mu = 1.740$ kilograms and a standard deviation of $\sigma = 0.030$ kilogram.

a: What are the mean and standard deviation of the sampling distribution of $\bar{X}$ for a random sample of size (1) $n = 9$, (2) $n = 50$? (10%)

b: For a random sample of 50 bricks, find the probability that the sample mean will (1) exceed 1.745, (2) lie within ± 0.005 of μ. (10%)

c: For a random sample of 50 bricks, within what interval centered around μ will $\bar{X}$ fall with probability 0.90? What is the corresponding interval when $n = 100$? What is the effect of the larger sample size on the width of the interval? (10%)

6. 20% In a test involving highway cruising at 55 miles per hour, eight new cars of a certain make were randomly selected from the production line, and each was driven 1000 miles without an oil additive and 1000 miles with an oil additive. The order of the two runs was independently randomized for each car. Let X_1 and X_2 denote the miles per gallon for a car without and with the oil additive, respectively. Data for the differences $D = X_2 - X_1$ follow:

Car:	1	2	3	4	5	6	7	8
D:	1.87	1.71	2.38	2.19	1.89	1.96	1.76	2.00

Assume that the population of differences is normal.

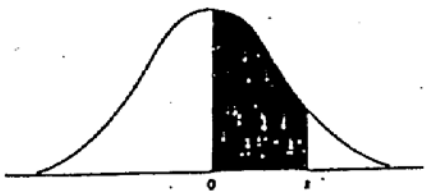
a: Construct a 90 percent confidence interval for $\mu_2 - \mu_1$, the difference in the mean miles per gallon with and without the additive. Interpret the confidence interval. (10%)

b: Test whether the oil additive increases the mean gas mileage. Control the α risk at 0.05 when $\mu_D = \mu_2 - \mu_1 = 0$. State the alternatives, the decision rule, the value of the test statistic, and the conclusion. (10%)

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：工業管理系碩士班　組別：甲、乙、丙、丁組　科目：統計學

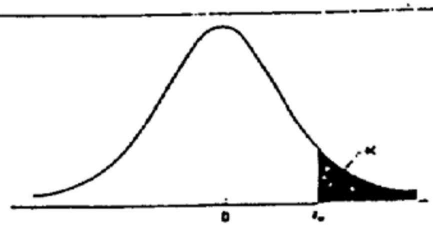
Areas Under the Standard Normal Curve



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	.3485	.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	.4452	.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	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.49865	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
4.0	.49997									

Student t Distribution



The following table provides the values of t_α that correspond to a given upper-tail area α 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	6.314	12.706	31.821	63.657	127.32	318.31	636.62
2	.289	.816	1.886	2.920	4.303	6.965	9.925	14.089	22.327	31.598
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	4.604	5.598	7.173	8.610
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869
6	.265	.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959
7	.263	.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408
8	.262	.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041
9	.261	.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781
10	0.260	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587
11	.260	.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437
12	.259	.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318
13	.259	.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221
14	.258	.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073
16	.258	.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015
17	.257	.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965
18	.257	.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922
19	.257	.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883
20	0.257	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850
21	.257	.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819
22	.256	.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792
23	.256	.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767
24	.256	.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745
25	0.256	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725
26	.256	.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707
27	.256	.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690
28	.256	.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674
29	.256	.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659
30	0.256	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646
40	.255	.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551
60	.254	.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460
120	.254	.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373
∞	.253	.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291