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一、Multiple Choices (Only one choice is correct!)

1. (5%)For the three distributions, Poisson, Exponential(Exp), and Gamma, one and only one of the following statements is correct. Which one?
   a. the expected values of Poisson and Exponential distributions are the same.
   b. Gamma $(3, \lambda)$ = Exp(λ)+ Exp(λ)+ Exp(λ), as time goes on.
   c. The standard deviation of Poisson distribution is equal to the expected value of Poisson distribution.
   d. The exponential distribution is often referred to the number of occurrences of an event over a specified interval of time.
2. (5%) For testing the equality of two populations' variances, what is the correct procedure of the following actions?
   A. Reject H_0 if p-value < α
   B. Compute the test statistics F=(variance from sample 1/variance from sample 2)
   C. Check if these two populations are normally distributed
   D. Setup the null and alternative hypotheses
   E. Selecting an appropriate significance level, α

   a.DEBAC
   b.EDABC
   c.BCAED
   d.CDEBA

二、Calculation and Terminology

1. (10%) Three machines A, B, and C produce respectively 60%, 30%, and 10% of the total number of items of a factory. From previous record, the percentages of the defective output of these machines are 2%, 3%, and 4%, respectively. Suppose an item is selected at random and is found defective. What is the probability that the item was produced by machine A?
2. (14%) An electrical firm manufactures a product that has a life time that is normally distributed with a mean of 800 hours and a standard deviation of 40 hours. For the quantity of 1,000 in this product, how many will have life times between 778 and 834 hours?
3. (16%) An *estimator* can be defined as a rule that tells how to calculate the value of an estimate based on the measurement contained in a sample. We often want to use an *unbiased estimator* for a point estimation, what exactly the meaning of "***unbiased***" ? Please explain it by example without equations.

(背面仍有題目,請繼續作答)

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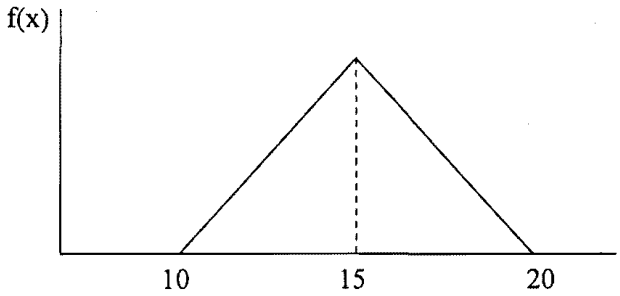
三、If we are going to test whether it is appropriate to assume that the lifetime of the batteries manufacturing by a company follow a triangular distribution as shown in the following figure. Suppose that the lifetimes of 100 batteries are tested and recorded for identifying the assumption.

1. (3%) Formulate the null hypothesis.
2. (3%) Let interval [10, 20] be divided into d subintervals for hypothesis testing. Give the upper bound of d, and explain.
3. (8%) If d = 5, specify subinterval boundaries and state the procedure for calculating the test statistic.
4. (3%) After calculating the test statistic, by the critical value approach, how to know whether the lifetime of the batteries can be assumed to follow the triangular distribution?



四、Six leaves of some kind of plant are collected from each one of five different locations. The mean and standard deviation of the length of the leaves are summarized in the following table. The ANOVA will be used to determine whether the mean lengths of the leaves from different locations are significantly different under a 95% confidence level.

Location	1	2	3	4	5
Mean	13.68	15.95	13.67	14.73	13.08
St. Dev.	1.197	1.167	0.816	0.940	0.479

1. (2%) Formulate the null hypothesis.
2. (6%) What are the necessary assumptions for this hypothesis testing?
3. (6%) Construct the ANOVA table.

五、Suppose that the production amount (denoted by x with unit thousand tons) for some kind of fruit can be used to predict its price (denoted by y with unit NT$ per kilogram). Ten observations for x and y are given in the following table.

x_i	1.4	6.6	7.0	3.1	0.4	0.5	5.2	9.8	2.5	7.5
y_i	91.7	67.2	68.6	82.8	96.6	97.6	73.5	50.8	85.7	61.5

1. (5%) Derive a linear regression line to approximate the relationship between production amount and price and interpret it.
2. (3%) Calculate the coefficient of determination and interpret it.
3. (5%) Formulate the null hypothesis and calculate the test statistic for the test of significance.
4. (3%) Develop a 95% confidence interval estimate of mean price when production amount is 4,800 tons.
5. (3%) Develop a 95% confidence interval estimate of price when production amount is 1,900 tons.

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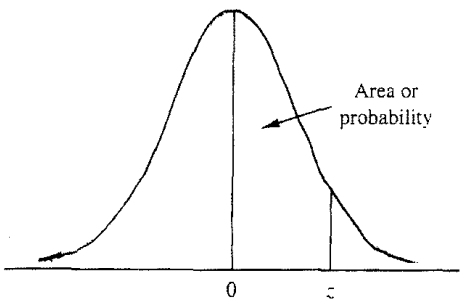

Entries in the table give the area under the curve between the mean and z standard deviations above the mean. For example, for $z = 1.25$ the area under the curve between the mean and z is .3944.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.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	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

(背面仍有題目,請繼續作答)

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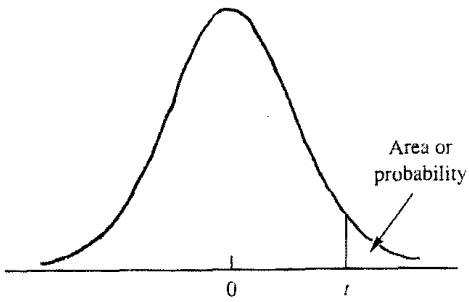

Entries in the table give t values for an area or probability in the upper tail of the t distribution. For example, with 10 degrees of freedom and a .05 area in the upper tail, $t_{.05} = 1.812$.

Degrees of Freedom	Area in Upper Tail					
	.20	.10	.05	.025	.01	.005
1	1.376	3.078	6.314	12.706	31.821	63.656
2	1.061	1.886	2.920	4.303	6.965	9.925
3	.978	1.638	2.353	3.182	4.541	5.841
4	.941	1.533	2.132	2.776	3.747	4.604
5	.920	1.476	2.015	2.571	3.365	4.032
6	.906	1.440	1.943	2.447	3.143	3.707
7	.896	1.415	1.895	2.365	2.998	3.499
8	.889	1.397	1.860	2.306	2.896	3.355
9	.883	1.383	1.833	2.262	2.821	3.250
10	.879	1.372	1.812	2.228	2.764	3.169
11	.876	1.363	1.796	2.201	2.718	3.106
12	.873	1.356	1.782	2.179	2.681	3.055
13	.870	1.350	1.771	2.160	2.650	3.012
14	.868	1.345	1.761	2.145	2.624	2.977
15	.866	1.341	1.753	2.131	2.602	2.947
16	.865	1.337	1.746	2.120	2.583	2.921
17	.863	1.333	1.740	2.110	2.567	2.898
18	.862	1.330	1.734	2.101	2.552	2.878
19	.861	1.328	1.729	2.093	2.539	2.861
20	.860	1.325	1.725	2.086	2.528	2.845
21	.859	1.323	1.721	2.080	2.518	2.831
22	.858	1.321	1.717	2.074	2.508	2.819
23	.858	1.319	1.714	2.069	2.500	2.807
24	.857	1.318	1.711	2.064	2.492	2.797
25	.856	1.316	1.708	2.060	2.485	2.787
26	.856	1.315	1.706	2.056	2.479	2.779
27	.855	1.314	1.703	2.052	2.473	2.771
28	.855	1.313	1.701	2.048	2.467	2.763
29	.854	1.311	1.699	2.045	2.462	2.756
30	.854	1.310	1.697	2.042	2.457	2.750
40	.851	1.303	1.684	2.021	2.423	2.704
50	.849	1.299	1.676	2.009	2.403	2.678
60	.848	1.296	1.671	2.000	2.390	2.660
80	.846	1.292	1.664	1.990	2.374	2.639
100	.845	1.290	1.660	1.984	2.364	2.626
∞	.842	1.282	1.645	1.960	2.326	2.576