國立台灣科技大學九十六學年度碩博士在職專班招生試題

系所組別： 管理研究所EDBA博士在職專班甲組、乙組、丙組、丁組

科　　目： 統計學

統計學

共七題, 總計 100 分。依序作答。

1. (10%) Let X be the difference (possible negative) between the number of heads and the number of tails in 4 tosses of a coin. Find the distribution of X.

2. (10%) You are given a task, say painting a fence. The probability that the task will be completed if k friends are helping you is p_k $(k = 0, 1, 2, \ldots)$. If j friends already helped you, the probability that the $(j+1)$-st will also help is π_j $(j = 0, 1, 2, \ldots)$. On the other hand, if the jth friend did not help, then the $(j+1)$-st will not help either. Find the probability that the task will be completed.

3. (15%) Suppose that a sequence of Bernoulli trials is to be carried out with an unknown probability θ of success on each trial, and the following hypotheses are to be tested:

$$H_0: \ \theta = 0.1,$$
$$H_1: \ \theta = 0.2.$$

Let X denote the number of trials required to obtain a success, and suppose that H_0 is to be rejected if $X \leq 5$. Determine the probabilities of errors of type 1 and 2.

4. (15%) Suppose that random sample $\{X_1, \ldots, X_{25}\}$ is drawn from $N(\mu, \sigma^2 = (7.5)^2)$ with μ unknown. The goal is to test $H_0 : \mu = 30$ against $H_1 : \mu > 30$. Suppose that the *rejection region* is

$$\left\{ (X_1, \ldots, X_{25}) \middle| \bar{X} = \sum_{i=1}^{25} X_i/25 \geq 33 \right\}.$$

(a) (5%) Find the significance level of the test.

(b) (5%) Find the *power* of this test at $\mu = 33$.

(c) (5%) What is the *p-value* corresponding to $\bar{X} = 33$.

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5. (15%)

   (a) What do you mean by modern statistics?

   (b) What is the difference between descriptive and inferential statistics?

   (c) Under what circumstances might each of these areas of statistics be more useful?

6. (20%) The LuShen Steel Company manufactures steel bars. If the production process is working properly, it turns out steel bars with an average length of at least 2.8 feet with a standard deviation of 0.20 foot (as determined from engineering specifications on the involved production equipment). Longer steel bars can be used or altered; shorter bars must be scrapped. A sample of 25 bars is selected from the production line. The sample indicates an average length of 2.73 feet. The company wishes to determine whether the production equipment needs any adjustment.

   (a) State the null and alternative hypotheses.

   (b) If the company wishes to test the hypothesis at the 0.05 level of significance, what decision would it make?

7. (15%) The owner of a dry cleaning business, in an effort to measure the quality of the services provided, would like to study the number of dry-cleaned items that are returned for rework per day. Records were kept for a four-week period (the store is open Monday-Saturday) with the results indicated as follows:

Day	Items Returned for Rework	Day	Items Returned for Rework
1	4	13	5
2	6	14	8
3	3	15	3
4	7	16	4
5	6	17	10
6	8	18	9
7	6	19	6
8	4	20	5
9	8	21	8
10	6	22	6
11	5	23	7
12	12	24	9

   (a) Set up a c-chart for the number of items per day that are returned for rework. Do you think that the process is in a state of statistical control?

   (b) Should the owner of the dry cleaning store take action to investigate why 12 items were returned for rework on day 12? Explain. Would your answer be the same if 20 items were returned for rework on day 12?

   (c) On the basis of the results in (a), how should the owner of the dry cleaning store proceed in setting up a process to reduce the number of items per day that are returned for rework?

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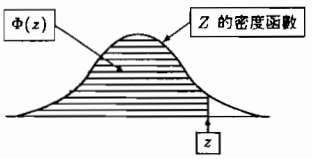

標準常態分布累積機率函數 $\Phi(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-t^2/2}\, dt = \mathrm{P}(Z \le z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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