國立成功大學
114學年度碩士班招生考試試題

編　號：208

系　所：環境醫學研究所

科　目：生物統計

日　期：0211

節　次：第 2 節

注　意：1.可使用計算機
　　　　2.請於答案卷(卡)作答，於
　　　　試題上作答，不予計分。

Please provide complete and detailed calculations. If only answers are provided, then no credits are to be given.

A. (20% with 10% each)

A package of 100 chips contains 25 that are defective. If 10 of them are randomly chosen for inspection, what is the probability that 2 out of the 10 will be defective by using

1. the formula for the hypergeometric distribution;
2. the formula for the binomial distribution as an approximation.

B. (20%)

Prove that for the Poisson distribution

$$\frac{f(x+1;\ \lambda)}{f(x;\ \lambda)} = \frac{\lambda}{x+1} \quad \text{for x = 0, 1, 2, 3 ......}$$

C. (20% with 10% each)

If the amount of cosmic radiation to which a person is exposed while flying by jet airplane across the United States is a random variable having the normal distribution with mean 4.35 mrem and standard deviation 0.59 mrem, find the probabilities that the amount of cosmic radiation to which a person will be exposed on such a flight is:

1. between 4.00 and 5.00 mrem;
2. at least 5.50 mrem.

D. (10%)

If X_1 has mean 4 and variance 9, while X_2 has mean -2 and variance 5. The 2 random variables are independent, find **Var**$(2X_1 + X_2 - 5) = ?$

E. (20% with 10% each)

Blood pressure in childhood tends to increase with age, but differently for boys and girls. Suppose that for both boys and girls, mean systolic blood pressure (SBP) is 95 mm Hg at 3 years of age and increases 1.5 mm Hg per year up to the age of 13. Furthermore, starting at age 13, the mean increases by 2 mm Hg per year for boys and 1 mm Hg per year for girls up to the age of 18. Finally, assume that blood pressure is normally distributed and that the standard deviation is 12 mm Hg for all age-sex groups.

1. What is the probability that a 15-year-old girl will have an SBP between 100 and 120 mm Hg?
2. What is the probability that at least 10 will have an SBP of 130 mm Hg or higher among 200 15-year-old boys?

F. **(10%)**

A study of the Massachusetts Department of Health found 46 deaths due to cancer among women in the city of Bedford, MA over the period 1974–1978, where 30 deaths had been expected from statewide rates. What is the probability of observing at least 46 deaths due to cancer if the statewide rates are correct?

Table 3   Normal Distribution Function

$$F(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-t^2/2} \, dt$$

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
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998									
4.0	0.99997									
5.0	0.9999997									
6.0	0.999999999									