國立臺灣大學96學年度碩士班招生考試試題

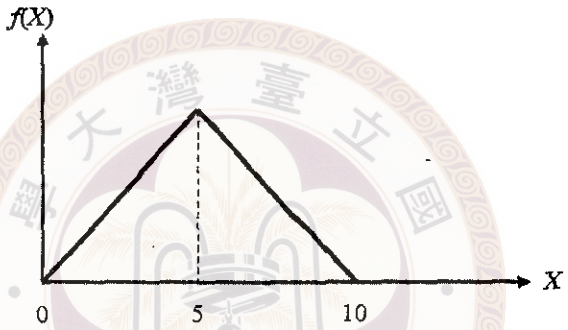
1. 下表爲一個母群體爲常態分布之隨機樣本(random sample)。

62	87	84	61	83	93
64	71	62	84	94	87

(a) 計算該樣本之平均值(mean)、中位數(median)與樣本變異數(sample variance)。[請列出計算式，且各計算結果取至小數點以下第二位] (10%)

(b) 假設該母群體之變異數爲 100，計算樣本平均值與母群體期望值之差值小於 5 之機率。 (10%)

2. 隨機變數 X 之機率密度函數(probability density function)如下圖所示。若(0.28, 0.20, 0.67)爲一母群體爲介於 0 與 1 間之均勻分布(Uniform distribution, U(0,1))之隨機樣本。



(a) 建立 X 之累積分布函數(cumulative distribution function) (10%)

(b) 利用上述均勻分布之隨機樣本，找出隨機變數 X 之一組樣本量(sample size)爲 3 之隨機樣本。 (10%)

3. 假設環境化學實驗室中某項水質檢測所需之時間具常態分布，且平均值爲 30 分鐘。張教授擬定一套新檢測程序，希望降低檢測時間。一研究助理被要求進行調查及統計檢定，以瞭解該新程序是否顯著降低水質檢測時間。該研究助理依據新程序完成 25 次該水質項目之檢測，其檢測時間之樣本平均值爲 28 分鐘，樣本標準偏差爲 4 分鐘。若你是該研究助理，

(a) 統計檢定之 null hypothesis(H_0)與 alternative hypothesis(H_1)應如何設定？ (10%)

(b) 在 0.05 之顯著水準(level of significance)下，該新檢測程序是否顯著降低檢測時間？ (10%)

4. A chemical plant produces a variety of products using four different processes; the available labor is sufficient only to run one process at a time. The discharge of dangerous pollution into the plant waste system and thence into a nearby stream is dependent on which process equipment is in operation. The probability that a particular process will be producing dangerous pollution products is as shown below: Process A: 40%, Process B: 5%, Process C: 30%, Process D: 10%.
All other processes in the plant are considered harmless. In a typical month the relative likelihoods of processes A, B, C and D operating through the month are 2:4:3:1, respectively.

(a) What is the probability that there will be no dangerous pollution discharged in a given month? (5%)

(b) If dangerous pollution is detected in the plant discharge, what is the probability that process A was operating? (5%)

(c) The pollution products that are discharged by the various processes have different probabilities of producing a fish kill in the stream that the plant uses for disposal, as

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follows.

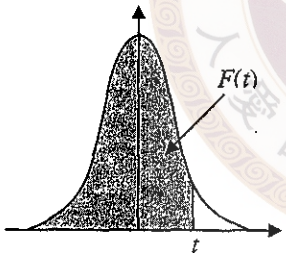
Process	Probability of fish kill
A	0.9
B	0.1
C	0.8
D	0.3

Based on these assumptions what is the probability that fish will be killed by pollution in the stream in a given month? (5%)

(d) Of the four processes, which is the most fruitful one (in terms of minimizing the likelihood of fish kill) to select for clean-up if only one can be improved? (5%)

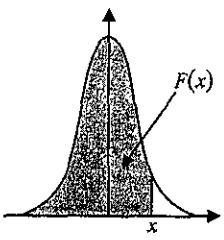
5. The time between successive arrivals of vehicles in a traffic flow were observed as 1.2, 3.0, 6.3, 10.1, 5.2, 2.4, and 7.1 seconds. Suppose the interarrival time of vehicles follows an exponential distribution; that is, $f_T(t) = \frac{1}{\lambda} e^{-t/\lambda}$. Determine the maximum likelihood estimate for mean interarrival time λ. (20%)

t 分布之累積分布函數(n:自由度(degree of freedom)，F:累積機率)



n \ F	.75	.90	.95	.975	.99
1	1.000	3.078	6.314	12.706	31.821
2	.816	1.886	2.920	4.303	6.965
3	.765	1.638	2.353	3.182	4.541
4	.741	1.533	2.132	2.776	3.747
5	.727	1.476	2.015	2.571	3.365
21	.686	1.323	1.721	2.080	2.518
22	.686	1.321	1.717	2.074	2.508
23	.685	1.319	1.714	2.069	2.500
24	.685	1.318	1.711	2.064	2.492

標準常態分布之累積分布函數



x	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319

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