1. Please find the **mean** and **variance** of the following p.d.f.

   (a) $f(x) = 1/5$, $x = 5, 10, 15, 20, 25$ (5%);　　(b) $f(x) = \dfrac{1}{b-a}$, $a \le x \le b$ (10%);

   (c) $f(x) = \dfrac{3!}{x!(3-x)!}(\dfrac{1}{4})^x(\dfrac{3}{4})^{3-x}$, $x = 0, 1, 2, 3$ (5%)

2. Given three events A1, A2, and A3 such that $P(A1) = 0.3$, $P(A2) = 0.6$, $P(A3) = 0.4$;

   $P(A1 \cap A2) = 0.2$, $P(A1 \cap A3) = 0.1$, $P(A2 \cap A3) = 0.3$; and $P(A1 \cap A2 \cap A3) = 0.05$.

   Please find (a) $P(A1 \cup A2 \cup A3)$ and (b) $P(A1' \cap A2' \cap A3')$　　(10%)

3. Let $\bar{X}$ be the sample mean of a random sample of size 16 from $\mathcal{N}(2, 4)$, and let $\bar{Y}$ be the sample mean of another random sample of size 4 from **the same parent population**.

   (1) What are the distributions of $\bar{X}$ and $\bar{Y}$, respectively? (5%)

   (2) What is the distribution of $\bar{X} - \bar{Y}$ (5%)

   (3) Please find the probability $P(\bar{X} - \bar{Y} > 0)$ (5%)

4. Let $f(x)$ be the p.d.f. of a binomial distribution. Using the **binomial theorem**, please show

   that $\sum_{x=0}^{n} f(x) = 1$. (25%)

5. An animal ecologist suggests three methods to prevent squirrels from damaging

   Cryptomeria plantations. To determine the effectiveness of the three methods, a small

   experiment was conducted with **9** replications for each treatment (method). The **Treatment**

   Total of each method is listed below. Mean square error (**MSE**) of the experiment is **60**.

   Please **(1)** state an appropriate model and its assumptions, **(2)** state the null and alternative

   hypotheses, and **(3)** construct a complete ANOVA table based on the given information and

   state your conclusions. Let the type I error rate of the test be 0.05. Please use **Table 1** to

   find the critical value for the test. Assuming all the regular assumptions hold. (30%)

	Method		
	I	II	III
Treatment Total	243	324	189

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Table 1. The entries are the probabilities $P(X \geq x) = 0.05$, where X follows an F-distribution with numerator degrees of freedom n, and denominator degrees of freedom m

denominator degrees of freedom m	Numerator degrees of freedom n					
	1	2	3	4	5	6
20	4.35	3.49	3.10	2.87	2.71	2.60
21	4.32	3.47	3.07	2.84	2.68	2.57
22	4.30	3.44	3.05	2.82	2.66	2.55
23	4.38	3.42	3.03	2.80	2.64	2.53
24	4.26	3.40	3.01	2.78	2.62	2.51
25	4.24	3.39	2.99	2.76	2.60	2.49
26	4.23	3.37	2.98	2.74	2.59	2.47
27	4.21	3.35	2.96	2.73	2.57	2.46

試題隨卷繳回