

Mth3301
Homework #3 (Covers Modules 10-14)
Due October 20th

1. A die is rolled 5 times. Let X denote the number of times that you see a 3 or 6.
(a) What's the distribution of X ?
(b) Find $\Pr(X = 4)$.

2. Suppose $X \sim \text{Pois}(2)$. Find $\Pr(X \leq 3)$.

3. Suppose X has the following discrete distribution.

x	-1	0	2	3
$\Pr(X = x)$	$0.2c$	0.3	0.2	0.1

- (a) Find the value of c
(b) Find the c.d.f. $F(x)$ for all x .
(c) Calculate $E[X]$.
(d) Calculate $\text{Var}(X)$.
(e) Calculate $\Pr(1 \leq X \leq 2)$.

4. Suppose that X is continuous with p.d.f. $f(x) = cx^e$, $0 < x < 1$.

- (a) Find the value of c .
(b) Find the c.d.f. $F(x)$ for all x .
(c) Calculate $E[X]$.
(d) Calculate $\text{Var}(X)$.
(e) Calculate $\Pr(0 \leq X \leq 1/2)$.

5. Let $E[X] = -4$, $\text{Var}(X) = 5$, and $Z = -4X + 7$. Find $E[3Z]$ and $\text{Var}(3Z)$.

6. When a machine is adjusted properly, 50% of the items it produces are good and 50% are bad. However, the machine is *improperly* adjusted 10% of the time; in this case, 25% of the items it makes are good and 75% are bad. Suppose that 5 items produced by the machine are selected at random and inspected. If 4 of these items are good (and 1 is bad), what's the probability that the machine was adjusted properly at the time? (Hint: Try Bayes Theorem using Binomial conditional probabilities.)

7. Suppose that $X \sim \text{Unif}(-1; 6)$. Compare the upper bound on the probability $\Pr(|X - \mu| \geq 1.5\sigma)$ obtained from Chebychev's inequality with the exact probability.