

Undergraduates: Questions 1-3: 6 points. Question 4: 7 points. Don't do question 5  
 Graduates: Each question 5 points.

1. (6 points) Backton is connected to Crestville by three roads, and each road goes across a bridge, and they all use different bridges. The bridges are labeled A, B, and C. The probability that bridge A is up is 98%, the probability that bridge B is up is 97%, and the probability that bridge C is up is 96%. What is the probability that on any day an ambulance can drive from Crestville to the hospital in Backton?

$$\begin{aligned}
 P(\text{can}) &= 1 - P(\text{can't}) \\
 &= 1 - P(A \text{ out})P(B \text{ out})P(C \text{ out}) \\
 &= 1 - (1 - .98)(1 - .97)(1 - .96) \\
 &= 1 - .02 \times .03 \times .04 \\
 &= 1 - .000024 \\
 &= .999976
 \end{aligned}$$

2. (6 points) Pg 54, #6

$$\begin{aligned}
 1 &= P(X = 1) + P(X = 2) + P(X = 3) + P(X = 4) + P(X = 5) + P(X = 6) \\
 1 &= 3 \times P(X = 1) + 3 \times P(X = 2) \\
 &= 3 \times P(X = 1) + 3 \times 2 \times P(X = 1) \\
 &= 9P(X = 1) \\
 P(X = 1) &= \frac{1}{9}
 \end{aligned}$$

1	$\frac{1}{9}$
2	$\frac{2}{9}$
3	$\frac{1}{9}$
4	$\frac{2}{9}$
5	$\frac{1}{9}$
6	$\frac{2}{9}$

$$P(< 4) = \frac{1}{9} + \frac{2}{9} + \frac{1}{9} = \frac{4}{9}$$

3. (6 points) Pg 56 #14

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

- (a)  $\frac{1}{6}$
- (b)  $\frac{1}{3}$
- (c)  $\frac{11}{36}$
- (d)  $\frac{10}{30} = \frac{1}{3}$

4. (6 points) Pg 54, #7

$$\{E, OE, OOE, OOOE, \dots\} = \{O^*E\}$$

$$E \in \{2, 4, 6\}, \quad O \in \{1, 3, 5\}$$

Where  $O^*E$  indicates  $n$   $O$ s followed by one  $E$ ,  $n \geq 0$ .

5. (6 points) Pg 57 #17 Pick four items from the batch, a, b, c, d.  $P(a = \text{defective}) = .05$ ,  $P(a \text{ not defective}) = .95$ .

Pick the first item, and the probability it is not defective is  $\frac{95}{100}$ . Pick the second item, and the probability it is not defective is  $\frac{94}{99}$ . Pick the third item, and the probability it is not defective is  $\frac{93}{98}$ . Pick the second item, and the probability it is not defective is  $\frac{92}{97}$ .

$$\frac{95}{100} \times \frac{94}{99} \times \frac{93}{98} \times \frac{92}{97} = 0.811875$$

So, probability of all four being not defective =  $0.81187511 \approx .812$ .