Course Number : Title
Assignment x Submission

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Bernoulli Distribution

1. (Navidi 4.1.2)

   (a) $p_X = 0.2$

   (b) $p_Y = 0.45$

   (c) $p_Z = 0.2 + 0.45 = 0.65$

   (d) No, if we assume a customer cannot order a red and white at the same time.

   (e) Yes, $p_X + p_Y = 0.2 + 0.45 = 0.65 = p_Z$

   (f) Yes, if X=1, then Y=0 and vis versa, so when ever the is a white or red, i.e. Z=1, then X+Y=1. And When there is neither, Z=0, X+Y=0

2. (Navidi 4.1.6)

   Table of 36 combinations

	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) Count from table: $p_X = \frac{6}{36} = \frac{1}{6}$

   (b) Count from table: $p_Y = \frac{5}{36}$

   (c) $p_Z = \frac{1}{36}$

   (d) No, as we roll doubles then we know if we also roll sum=6 then its double 3s, ie $\frac{1}{6}$, where $p_Y = \frac{5}{36}$, so we can say they are not independent.

   (e) $p_X p_Y = \frac{1}{6} \cdot \frac{5}{36} = \frac{5}{216}$
   $p_Z = \frac{1}{36}$
   So, no.

   (f) The only case where X=1 and Y=1 (XY=1) is double 3s, ie where Z=1. Therefore yes.

Binomial Distribution

3. (Navidi 4.2.4)
   $P(X = x) = \frac{N!}{x!(N-x)!} p^x (1-p)^{N-x} \ : \ p = 0.75, \ N = 10$

   (a) $P(X = 10) = \frac{10!}{10!(10-10)!} 0.75^{10} (1-0.75)^{10-10} \approx 0.05631$

   (b) $P(X = 8) = \frac{10!}{8!(10-8)!} \cdot 0.75^8 (1-0.75)^{10-8} = 0.28156$

   (c) $P(X \geq 8) = P(X = 8) + P(X = 9) + P(X = 10) = 0.05631 + 0.28156 + 0.18771 \approx 0.52558$

4. (Navidi 4.2.10)

   $x = 92, \ N = 100$

   (a) $\hat{p} = \frac{x}{N} = \frac{92}{100} = 0.92$
   $\sigma_p = \sqrt{\frac{p \cdot (1-p)}{N}} = \sqrt{\frac{0.92 \cdot 0.08}{100}} = 0.027129$

   (b) $\sigma_p = 0.01 \ : \ N = \frac{p \cdot (1-p)}{\sigma_p^2} = \frac{0.92 \cdot 0.08}{0.01^2} = 736$

Poisson Distribution

5. (Navidi 4.3.4)
   $P(X = x) = \frac{\lambda^x e^{-x}}{x!}$

   6 track per cm^2, over a $1cm^2$ area so $\lambda = 6$

   (a) $P(X = 7) = \frac{6^7 e^{-6}}{7!} = 0.13767$

   (b) Via the complement law:
   $P(X \geq 3) = 1 - P(X \leq 2) = 1 - (P(X = 0) + P(X = 1) + P(X = 2))$
   $P(X = 0) = \frac{6^0 e^{-6}}{0!} = \frac{1}{e^6} \approx 0.00247$
   $P(X = 1) = \frac{6^1 e^{-6}}{1!} = \frac{6}{e^6} \approx 0.01487$
   $P(X = 2) = \frac{6^2 e^{-6}}{2!} = \frac{18}{e^6} \approx 0.04461$
   $P(X \geq 3) = 1 - (1/e^6 + 6/e^6 + 18/e^6) \approx 0.938031$

   (c) $P(2 < X < 7) = P(X = 3) + P(X = 4) + P(X = 5) + P(X = 6)$
   $P(X = 3) = \frac{6^3 e^{-6}}{3!} = \frac{36}{e^6} \approx 0.08923$
   $P(X = 4) = \frac{6^4 e^{-6}}{4!} = \frac{54}{e^6} \approx 0.13385$
   $P(X = 5) = \frac{6^5 e^{-6}}{5!} = \frac{324}{5e^6} \approx 0.16062$
   $P(X = 6) = \frac{6^6 e^{-6}}{6!} = \frac{324}{5e^6} \approx 0.16062$
   $P(2 < X < 7) = (0.08923 + 0.13385 + 0.16062 + 0.16062) = 0.54432$

   (d) $\mu_X = \lambda = 6$

   (e) $\sigma_X = \sqrt{\lambda} = \sqrt{6} \approx 2.44949$

6. (Navidi 4.3.10)
   $X = \frac{48}{3} = 16$
   $\sigma_X = \sqrt{\frac{X}{t}} = \sqrt{\frac{16}{3}} = 2.309401$
   $= 16 \pm 2.31$