Practice Exam 3: Chps 5 & 6

Solutions

1) a) X is a numeric random variable.

2) \( P(X) = 0.999 \) (close to 1) \( \checkmark \)

3) \( 0 \leq P(X) \leq 1 \) for each \( X \) \( \checkmark \)

Yes, the table describes a probability distribution since it meets all 3 requirements.

b) \( \mu = \frac{4}{10} \) flights \( \checkmark \)

\( \lambda = 0.9 \) flights

c) \( P(X = 2) = 0.048 \rightarrow \) It is unlikely because

\( 0.048 \leq 0.05 \)

d) \( P(X \leq 2) = P(X = 2) + P(X = 1) + P(X = 0) = 0.048 + 0.006 + 0.054 \)

Two is not considered an unusually low number since 0.054 > 0.05.

2) a) \( \mu = \frac{35.4}{365} \) deaths/day \( \text{(Poisson and discrete)} \)

b) \( P(X > 2) = P(X \geq 3) = 1 - P(X \leq 2) = 1 - \text{poisson cdf}(\frac{35.4}{365}, 2) \)

\( = 0.00141 \)

c) \( P(X = 2) = \frac{0.00427}{\text{poisson pdf}(\frac{35.4}{365}, 2)} \)

3) normally distributed, select mean, weight (CLT and continuous)

\( \mu = 172 \)

\( \sigma = 29 \)

\( \bar{X} = 172 \text{ lb} \)

\( S_x = \frac{29}{\sqrt{100}} \text{ lb} \)

\( P(X > 175) = 0.322 \)

normal cdf(175; 10^99; 172; 29)
4) normally dist., temp (continuous)

\[ \mu = 98.2 \, ^\circ F \]
\[ \sigma = 2.0 \, ^\circ F \]

\[ P(X \geq 100.6) = 0.000542 \]

normal cdf: \( (100.6, 10, 98.2, 0.2) \)

5) a) "winning" roll odd = 1, 3, 5
   win \( \rightarrow \) $1 \, $3 \, $5
   roll even \( \rightarrow \) 2, 4, 6
   "win" \( \rightarrow \) $-4 \, $-4 \, $-4

   Probabilities:
   \[ P(1) = \frac{1}{6}, P(3) = \frac{1}{6}, P(5) = \frac{1}{6} \]
   \[ P(-4) = \frac{1}{6}, P(6) = \frac{1}{6} \]

   b) \( E = -4 \left( \frac{1}{6} \right) + 1 \left( \frac{1}{6} \right) + 3 \left( \frac{1}{6} \right) + 5 \left( \frac{1}{6} \right) = -\frac{5}{6} \) or \(-0.833\)

   (by hand)

   or \( E = \mu = -0.833 \) (use TI)

   * 2 outcomes
   yellow/not yellow (discrete & Binomial)
   \( n = 580 \)
   \( p = 0.25 \)
   \( q = 0.75 \)

d) \( \mu = 580(0.25) = 145.0 \) yellow peas
\[ \sigma = \sqrt{(580)(0.25)(0.75)} = 10.4 \] yellow peas

b) \( \max = 145 + 2(10.4) = 165.8 \)
\( \min = 145 - 2(10.4) = 124.2 \)

Since 152 is within the range of usual x values, usual
so 124.2 \( \leq \) x-values \( \leq \) 165.8

152 yellow peas is not unusually high.
Using the range of values from part b, we can see that 119 is below the minimum usual value of 124.2. So, yes, getting 119 yellow peas is an unusually slow number.

7) **Weights, normally dist.**

- **a)**
  \[ \mu = 15 \text{ lb} \quad \sigma = 3 \text{ lb} \]
  \[ P(X < 13) = \frac{252}{\text{normalcdf}(-10.99, 13, 15, 3)} \]

- **b)**
  \[ \mu = 15 \text{ lb} \quad \sigma = 3 \text{ lb} \]
  \[ P(13 \leq X \leq 17) = \frac{.495}{\text{normalcdf}(13, 17, 15, 3)} \]

8) **Normal dist., cost**

- **a)**
  \[ \mu = 625 \text{ lb} \quad \sigma = 75 \text{ lb} \]
  \[ P(X < 700) = \frac{691}{\text{normalcdf}(-10.99, 700, 625, 150)} \]

- **b)** Select 10, mean cost \[ \frac{\mu_X}{10} = 62.5 \text{ lb} \quad \sigma_X = \frac{75}{\sqrt{10}} \]
  \[ P(X < 700) = \frac{94.3}{\text{normalcdf}(-10.99, 700, 625, \frac{150}{\sqrt{10}})} \]
9) Have a website/don't have (discrete & binomial)

\[ n = 10 \quad p = 0.3 \]

\[ P(X = 4) = \frac{\text{200}}{\text{binompdf}(10, 0.3, 4)} \]

10) Every 20 weeks = over time (discrete & Poisson)

a) \[ \lambda = \frac{3}{20} \] failures/week or \[ \lambda = 0.15 \] failures/week

b) \[ P(X < 2) = P(X \leq 1) = \frac{0.990}{\text{poisson cdf}(0.15, 1)} \]

c) \[ P(X \geq 2) = 1 - P(X \leq 1) = \frac{0.010}{1 - \text{poisson cdf}(0.15, 1)} \]

* Could use answer from part b \[ \rightarrow P(X \geq 2) = 1 - P(X \leq 1) = 1 - 0.990 = 0.01 \]

11) \[ n = 64 \quad p = 0.5 \] it's a girl \[ P(\text{girl}) = \frac{1}{2} \] P(\text{boy}) = \[ \frac{1}{2} \]

* 2 outcomes \[ \rightarrow \] girl or not a girl (discrete & binomial)

\[ P(X \geq 42) = 1 - P(X \leq 41) = \frac{0.00843}{1 - \text{binomcdf}(64, 0.5, 41)} \]

Since the probability is 0.00843, which is less than or equal to 0.05, then getting at least 42 girls in 64 births is an unusually high number of girls.