

Part 1

$$a) \left. \begin{aligned} P_1(x) &= \begin{cases} 0 & x < 0 \\ 1 & 0 < x < 1 \\ 0 & x \geq 1 \end{cases} \\ P_2(x) &= \begin{cases} 0 & x < -1 \\ 1/2 & -1 < x < 1 \\ 0 & x \geq 1 \end{cases} \end{aligned} \right\} P(x) = \begin{cases} 0 & x < -1 \\ 1/2 & -1 < x < 0 \\ 3/2 & 0 < x < 1 \\ 0 & x \geq 1 \end{cases}$$

$$b) \text{PDF: } f(x) = \lambda e^{-\lambda x} = 8e^{-8x}, \quad x > 0$$
$$\Rightarrow \text{CDF: } F(x) = 1 - e^{-8x}$$

$$\text{Poisson: } P(X=k) = \frac{8^k e^{-8}}{k!}$$

Part 2

$$a) E(A) = \sum_x x P(x=a) + \sum_y y P(y=a) = 2 \sum_x x P(x=a)$$
$$= \frac{2}{6} (21) = 7 //$$

$$STD(A) = \sqrt{VAR(A)} = \sqrt{2VAR(X)} = \sqrt{2 \sum_x \frac{1}{6} (x-3.5)^2} = 2.414 //$$

$$b) E(X) = np = 25/4 = 6.25$$
$$VAR(X) = np(1-p) = 4.68$$

$$c) E(X) = \frac{b+a}{2} = 15$$

$$E(X^3) = \int_{10}^{20} x^3 \frac{1}{10} dx = 3780 //$$

Part 3

a) $p = 0.15$ defective $\Rightarrow p' = 0.85$

$$P = \binom{3}{2} 0.85^2 0.15 + 0.85^3 = \underline{\underline{0.946}}$$

b) $P_{(x=k)} = \frac{3^k e^{-3}}{k!} \Rightarrow P(X=3) = \frac{3^3 e^{-3}}{3!} = \underline{\underline{0.074}}$

c) a) $E(X) = \int_0^{\infty} 3x e^{-3x} dx = 1/3$

b) $\int_0^{5/60} 3 e^{-3x} dx = \underline{\underline{0.22}}$

Part 4

\Rightarrow

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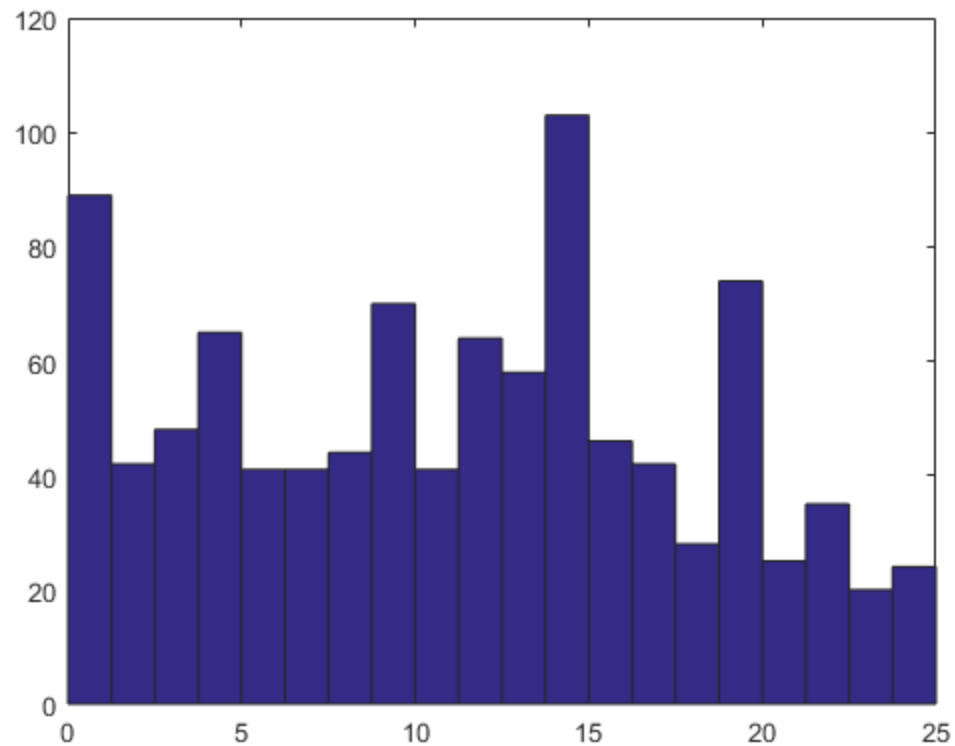
a) Probability that A wins

```
n=10000;  
B=randi([0 25],n);  
A=randi([12 30],n);  
p = sum(sum(A<B))/n^2
```

$p =$
0.1842

b) Histogram

```
n=1000;  
B=randi([0 25],n,1);  
A=randi([12 30],n,1);  
  
times = A.*(A<B)+B.*(B<A);  
hist(times,20)
```



c) 12 Horse Race

```
n=100000;  
B=randi([0 25],n,1);  
A=randi([12 30],n,1);  
all = [A,B,normrnd(37,19,n,10)];  
  
pA=sum(sum repmat(A,1,11)<all(:,2:end),2)==11)/n  
pB=sum(sum repmat(B,1,11)<[all(:,1) all(:,3:end)],2)==11)/n  
  
pA =  
    0.0461  
pB =  
    0.3474
```

d) Betting

```
takeA=1<8*pA  
takeB=1<5*pB  
  
takeA =  
    0  
takeB =  
    1
```

