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Assignment 4

$\frac{20}{60} + \frac{30}{60} + \frac{10}{60} + \frac{15}{60} + \frac{12}{60} + \frac{10}{60}$ $\frac{97}{60}$ $\frac{60}{147}$

$\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}$ $\frac{20}{49}$

1.A

$$P_A(a) = \begin{cases} \frac{1}{a} \cdot \frac{20}{49} & a = \{1, 2, 3, 4, 5, 6\} \\ \\ 0 & \text{else} \end{cases}$$

1.B

$P_A(\text{even}) = P_A(2) + P_A(4) + P_A(6)$ $= \cancel{0.0161}$

$\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{6}\right) \frac{20}{49}$ $= \boxed{0.373}$

2.A

$P[\text{Non-negative}] = 0.2 + 0.15 + 0.05 + 0.1 + 0.15 + 0.05$

$= \cancel{0.7}$

$\cancel{(.7)} \times \cancel{(.285)} = \boxed{0.7}$

2.B

$P[\text{INK} \leq 4] = .15 + .1 + .05 + .2 + .15 + .05$

$= \boxed{0.7}$

2.C

$P[\text{positive, odd}] = .15 + .05 + .1 + .15 = \boxed{.45}$

3.

$D = \{0, 1, 2, 3, 4\}$

A. $P_D(d) = \begin{cases} \binom{4}{d} (0.07)^d (1-0.07)^{4-d} & d = \{0, 1, 2, 3, 4\} \\ 0 & else \end{cases}$

$P_D(0) = 0.748$

$PD(1) = 0.225$

$PD(2) = 0.0254$

$PD(3) = 0.001$

$pD(4) = 0.00002$

≈ 0.999

RV D is a Binomial RV

B $P[Failure] = 1 - p[success] = 1 - 0.748 = \boxed{0.252}$

4.

A. Binomial RV F

$S_F = \{0, 1, 2, 3\}$

$S_F = \{0, 1, 2, 3\}$

B.

$P_F\left(\overset{3}{\cancel{x}}\right) = \binom{5}{3} (0.4)^3 \cdot (0.6)^2$

$= \cancel{0.768}$

.23

S. A

Assume Poisson

$T = 3$ minutes

$\lambda = 100$ customers / ~~6o~~ 60 minutes

$\alpha = \frac{100}{60} \cdot 3 = 5$ ~~customers~~

$P_c(0) = \frac{5^0 e^{-5}}{0!} = \boxed{0.006}$

S.B

$\frac{100}{60} \cdot 2 = 3.33$

$P_c(0) = \frac{3.33^0 e^{-3.33}}{0!} = 0.04$

$\frac{100}{60} \cdot 1 = 1.667$

$P_c(0) = \frac{1.66^0 e^{-1.66}}{0!}$

$\frac{100}{60} \cdot \frac{1}{2} = \frac{100}{120} = 0.83$

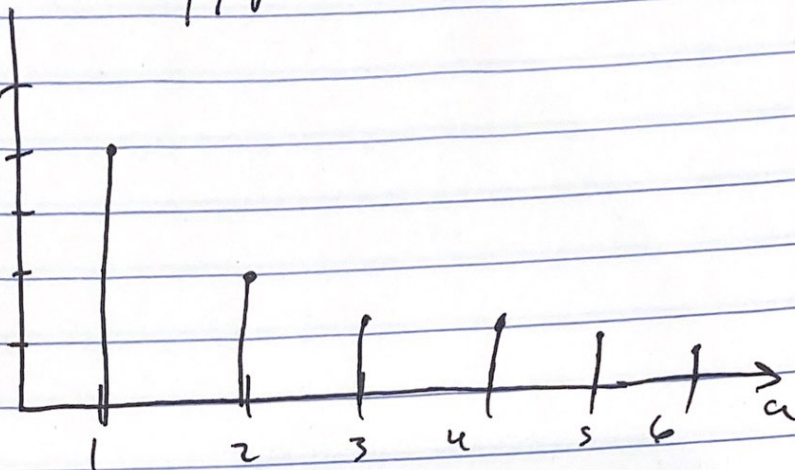$P_c^1(0) = \frac{0.83^0 e^{-0.83}}{0!} = \boxed{0.436}$

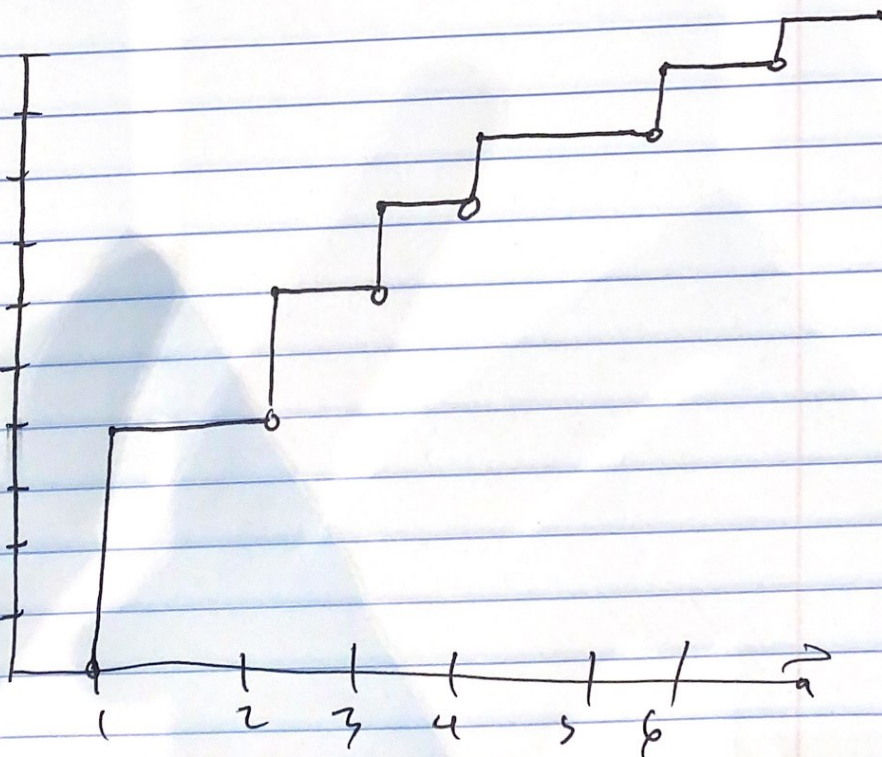$\boxed{\sim 30 \text{ seconds}}$
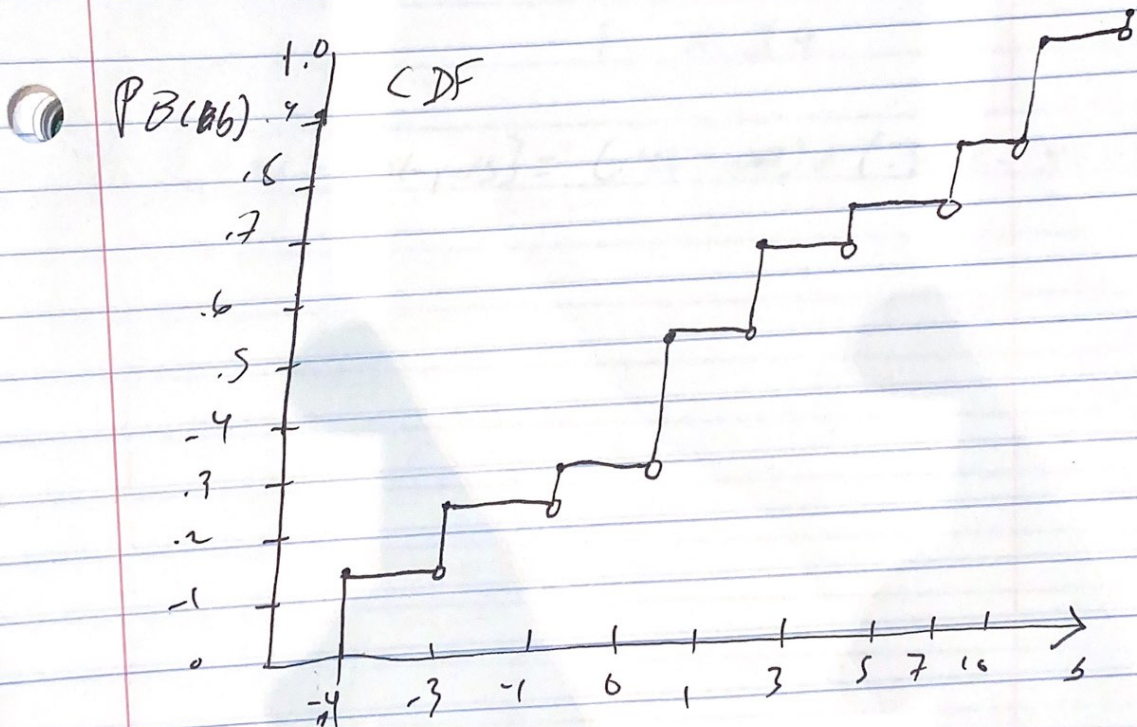
6.A

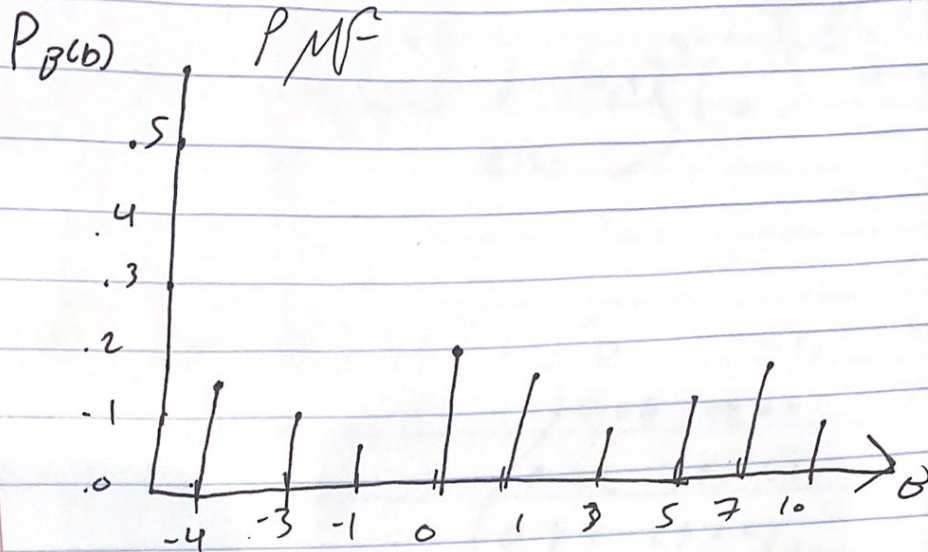$P_A(a)$ PMF

CDF

$P_A(a)$ 1

6.B

PMF

$P_B(b)$

axis marks: .5, .4, .3, .2, .1, 0

horizontal axis (b): -4, -3, -1, 0, 1, 3, 5, 7, 10

CDF

$P_B(\leq b)$

axis marks: 1.0, .4, .6, .7, .6, .5, .4, .3, .2, .1, 0

horizontal axis (b): -4, -3, -1, 0, 1, 3, 5, 7, 10

$$\binom{8}{5-b}\binom{4}{b}$$

7. A

$$\frac{\binom{\text{Ball}}{b}\binom{15-5}{5-b}}{\binom{15}{5}} \leftarrow \text{Total \# Bball}$$

$$P_B(b) = \begin{cases} \dfrac{\binom{8}{5-b}\binom{4}{b}}{\binom{12}{5}} & b = [0,4] \\ 0 & \text{else} \end{cases}$$

0: .07

.35

.42

$$\text{\# } F_B(b) = P[B \leq b] = \begin{cases} 0 & x < 0, \quad .14 \\ 0.07 & 0 \leq x < 1, \quad .01 \\ 0.42 & 1 \leq x < 2, \\ 0.84 & 2 \leq x < 3, \\ 0.98 & 3 \leq x < 4, \\ 1 & x \geq 4 \end{cases}$$

B. $P[1 \text{ or } 2 \text{ players}] = (.42 - .07) + (.84 - .42) = \boxed{0.77}$

```matlab
% intialize parameters
numPackets = 100;
packetLength = 100;
errorProb1To0 = 0.01;
errorProb0To1 = 0.03;
maxErrorsAllowed = 5;

% start counter for correctly decoded packets
correct_packets = 0;

% Simulate transmission of packets
for i = 1:numPackets
    % Generate 1 random packet off 100 length
    originalPacket = randi([0, 1], 1, packetLength);

    % Simulate transmission errors
    receivedPacket = originalPacket;
    for j = 1:packetLength
        if originalPacket(j) == 1
            % error for transmitting 1
            if rand < errorProb1To0
                receivedPacket(j) = 0;
            end
        else
            % error for transmitting 0
            if rand < errorProb0To1
                receivedPacket(j) = 1;
            end
        end
    end

    % Decode the packet if errors are within the allowed limit
    num_errors = sum(receivedPacket ~= originalPacket);
    if num_errors <= maxErrorsAllowed
        correct_packets = correct_packets + 1;
    end
end


p = 0.99; % probability of a bit being transmitted correctly
q = 0.03; % probability of a bit being transmitted incorrectly

% Calculate the probability of a packet being correctly decoded
probability_correct_decoding = 1 - (q)^5;

% Display the number of packets decoded correctly
disp(['Number of packets decoded correctly: ' num2str(correct_packets)]);
disp(['Relative frequency of packets decoded correctly: '
num2str(correct_packets/numPackets)]);
disp(['Theoretical probability of packet being right: ' num2str(0.999)]);
```

```
>> eecs461Assignment4
Number of packets decoded correctly: 97
Relative frequency of packets decoded correctly: 0.97
Theoretical probability of packet being right: 0.999
>>
```