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Assignment 4

$\frac{60}{60} + \frac{30}{60} + \frac{10}{60} + \frac{15}{60} + \frac{12}{60} + \frac{10}{60}$

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

$\frac{60}{147}$

$\frac{20}{49}$

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

$P_A(even) = P_A(2) + P_A(4) + P_A(6)$

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

2.A

P[Non-negative] = 0.2 + 0.15 + 0.05 + 0.1 + 0.15 + 0.05

= 0.7

2.B

P[INK #4] = .15 + .1 + .05 + .2 + .15 + .05

= 0.7

2.C

P[positive, odd] = .15 + .05 + .1 + .15 = .45

3.

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

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

$P_D(0) = 0.748$

$P_D(1) = 0.225$

$P_D(2) = 0.0254$

$P_D(3) = 0.001$

$P_D(4) = 0.00002$

≈ 0.999

RV D is a Binomial RV

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

4. A

Pascal F_1, $f = \{3, 4, 5, 6\}$ $S_f = \{0, 1, 2, 3\}$

$$P_f(f) = \begin{cases} \binom{f-1}{2}(.4)^2(.6)^{f-3} & f = [3, 6] \\ 0 & \text{else} \end{cases}$$

B.

$$P_f(3) + P_f(4) + P_f(5) + P_f(6) = \boxed{.7245}$$

S.A

Assume Poisson

$T = 3$ minutes

$\lambda = 100$ customers / 60 minutes

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

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

S.B

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

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

$\frac{100}{60} \cdot 1 = 1.66$

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

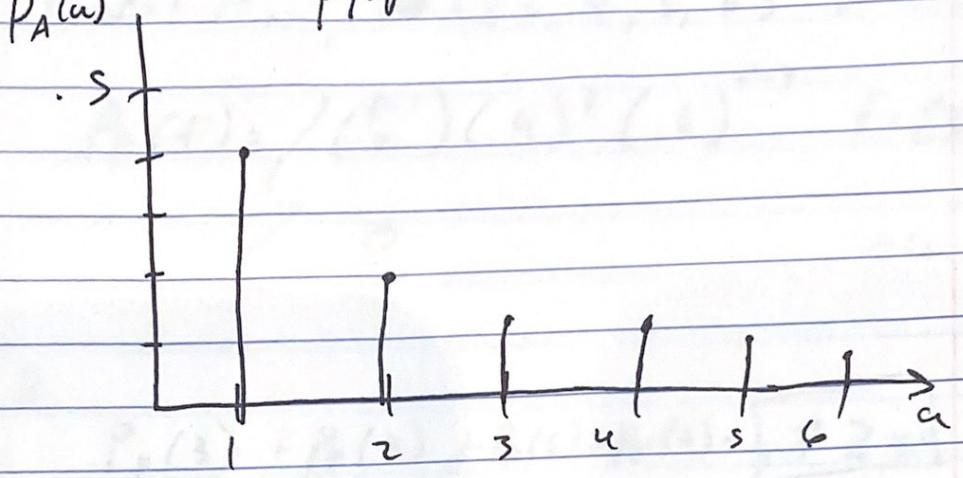
$\frac{100}{60} \cdot \frac{1}{2} = \frac{10}{12} = 0.83$

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

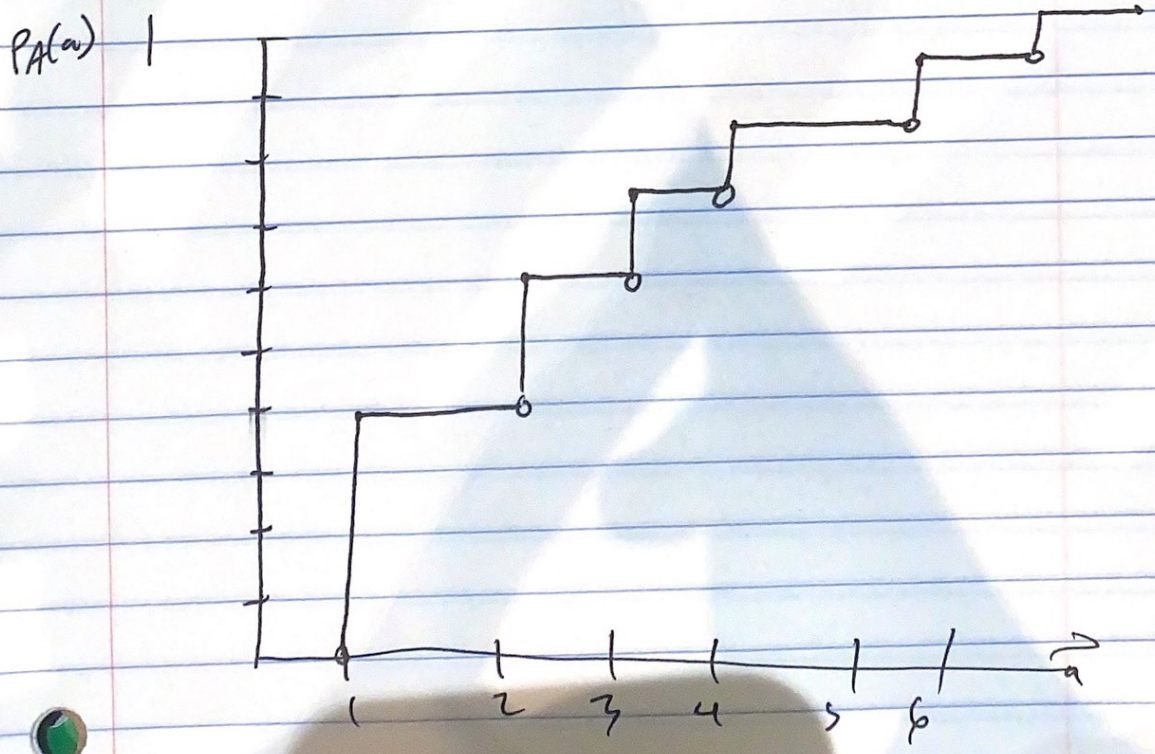
~ 30 seconds

6.A

PMF

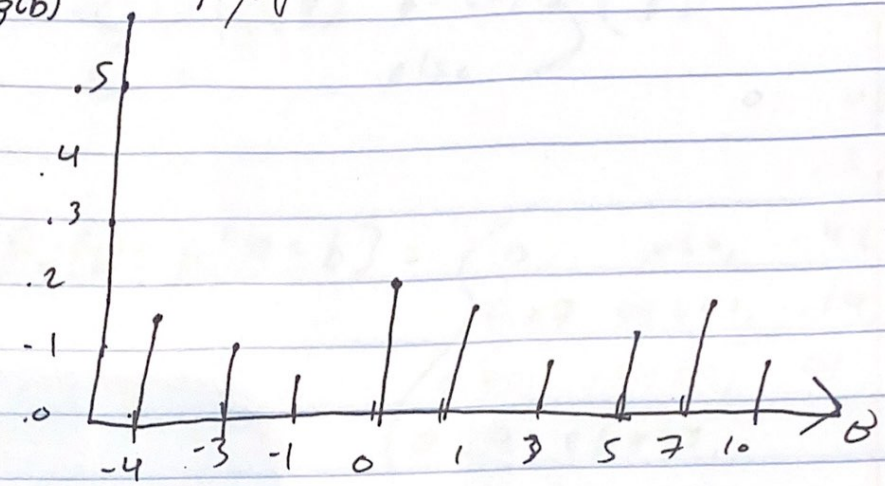


CDF

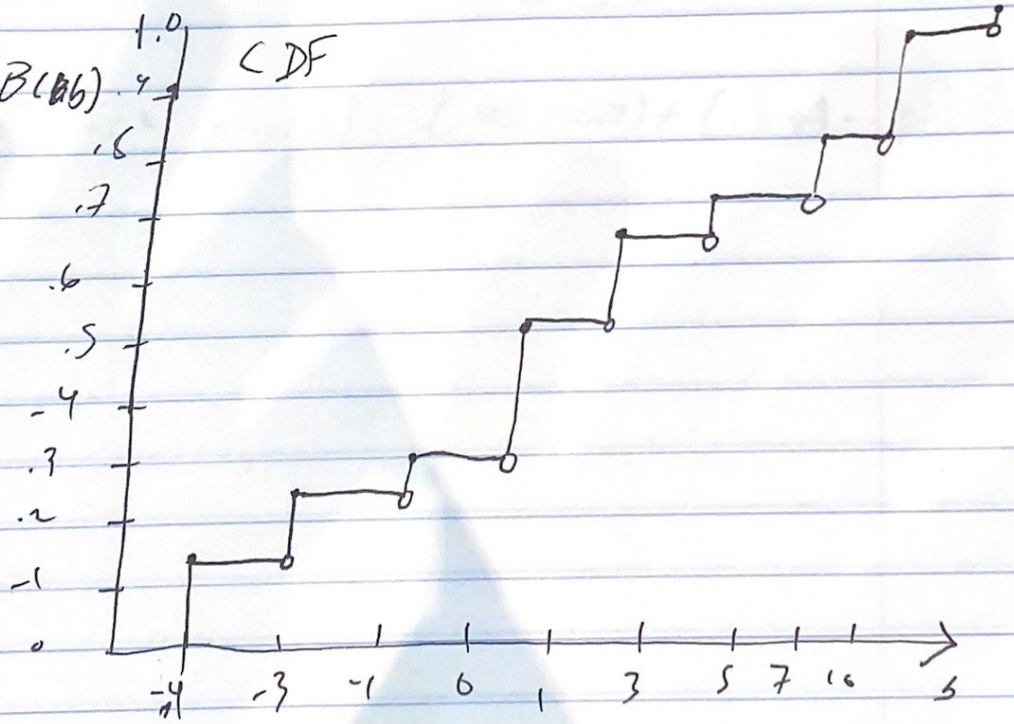


6.B

$P_B(b)$ PMF



$P_B(b)$ CDF



15

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

7. A

$$P_B(b) = \begin{cases} \dfrac{\binom{8}{5-b}\binom{4}{b}}{\binom{15}{5}} & b = [0,4] \\ 0 & \text{else} \end{cases}$$

← Total # Balls

$\binom{15-5}{5-b}$

0: .07

.35

.42

.14

.01

$$F_B(b) = P[B \le b] = \begin{cases} 0 & x < 0, \\ 0.07 & 0 \le x < 1, \\ 0.42 & 1 \le x < 2, \\ 0.84 & 2 \le x < 3, \\ 0.98 & 3 \le x < 4, \\ 1 & x \ge 4 \end{cases}$$

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

```
% 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
>>
```