10. MATLAB Problem:

a)

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| Results | | |
|  | x = 0 | x = 1 |
| y = 0 | .1291 | .1236 |
| y = 1 | .2489 | .4984 |

trials = 10000;

X = zeros(trials);

Y = zeros(trials);

XY = zeros(2,2);

for k=1:trials

val = rand(1);

if(val <= 1/8)

X(k) = 0;

Y(k) = 0;

XY(1,1) = XY(1,1)+1;

elseif(val <= 1/4)

X(k) = 1;

Y(k) = 0;

XY(1,2) = XY(1,2)+1;

elseif(val <= 1/2)

X(k) = 0;

Y(k) = 1;

XY(2,1) = XY(2,1)+1;

else

X(k) = 1;

Y(k) = 1;

XY(2,2) = XY(2,2)+1;

end

end

XY = XY ./ trials;

b)

pX\_x\_0 = sum(XY(:,1));%from previous method

pX\_x\_1 = sum(XY(:,2));%from previous method

Y\_x\_0 = zeros(trials,1);

Y\_x\_1 = zeros(trials,1);

|  |  |  |
| --- | --- | --- |
| Results | | |
|  | x = 0 | x = 1 |
| y = 0 | .1251 | .1207 |
| y = 1 | .2529 | .5013 |

Y\_0 = zeros(2,1);

Y\_1 = zeros(2,1);

XY\_2 = zeros(2,2);

for m=1:trials

val2 = rand(1);

%x=0

if(val2 <= 1/3)

Y\_x\_0(m) = 0;

Y\_0(1) = Y\_0(1)+1;

else

Y\_x\_0(m) = 1;

Y\_0(2) = Y\_0(2)+1;

end

%x=1

if(val2 <= 1/5)

Y\_x\_1(m) = 0;

Y\_1(1) = Y\_1(1)+1;

else

Y\_x\_1(m) = 1;

Y\_1(2) = Y\_1(2)+1;

end

end

Y\_0 = Y\_0 ./ trials .\* pX\_x\_0;

Y\_1 = Y\_1 ./ trials .\* pX\_x\_1;

XY\_2 = [Y\_0 Y\_1];

c)

|  |
| --- |
| 5/8 = .625 |

E(X) = ∑xpx(x) = 0\*(3/8) + 1\*(5/8) =

Simulated averages:

|  |
| --- |
| .622 |

Method 1) Avg = 0\*(.1291+.2489) + 1\*(.1236+.4984) =

|  |
| --- |
| .622 |

Method 2) Avg = 0\*(.1251+.2529) + 1\*(.1207+.5013) =

These values match fairly closely.

d)

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| 15/64 = .2344 |

var(X) = E(X2) – (E(X))2 = (02\*(3/8) + 12\*(5/8)) – (.625)2 =

Simulated variances:

|  |
| --- |
| .2351 |

Method 1 & 2) Var(X) = (0 + 12\*(.622)) – (.622)2 =

These values are also very close to the analytical ones.