

## Part D (a,b)

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close all;clear all;

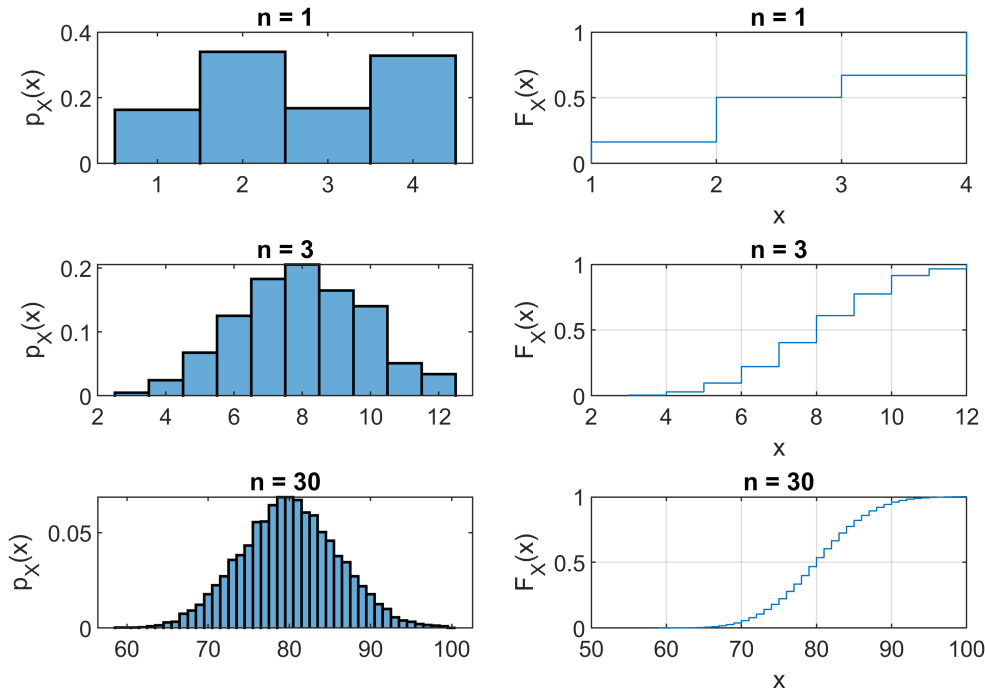
X=zeros(30,10000);
for i=1:30
    X(i,:) = randsample(4, 10000, true, [1/6 2/6 1/6 2/6]);
end

Sn = cumsum(X);

Gaussian_n_1 = makedist('Normal', mu=1 * (8/3), sigma=sqrt(11/9));
Gaussian_n_3 = makedist('Normal', mu=3 * (8/3), sigma=sqrt(3 * 11/9));
Gaussian_n_30 = makedist('Normal', mu=30 * (8/3), sigma=(sqrt(30 * 11/9)));

figure
s(1) = subplot(3,2,1) ;
    histogram(Sn(1,:), 'Normalization', 'pdf', LineWidth=1);
    title(s(1), 'n = 1')
    ylabel("p_X(x)")
s(2) = subplot(3,2,2) ;
    cdfplot(Sn(1,:))
    title(s(2), 'n = 1')
    ylabel("F_X(x)")
s(3) = subplot(3,2,3);
    histogram(Sn(3,:), 'Normalization', 'pdf', LineWidth=1)
    title(s(3), 'n = 3')
    ylabel("p_X(x)")
s(4) = subplot(3,2,4);
    cdfplot(Sn(3,:))
    title(s(4), 'n = 3')
    ylabel("F_X(x)")
s(5) = subplot(3,2,5);
    histogram(Sn(30,:), 'Normalization', 'pdf', LineWidth=1)
    title(s(5), 'n = 30')
    ylabel("p_X(x)")
s(6) = subplot(3,2,6);
    cdfplot(Sn(30,:))
    title(s(6), 'n = 30')
    ylabel("F_X(x)")
sgtitle({'PDF and CDF for S_n with n \in \{1, 3, 30\}'})
```

## PDF and CDF for $S_n$ with $n \in \{1, 3, 30\}$



### Part D (c)

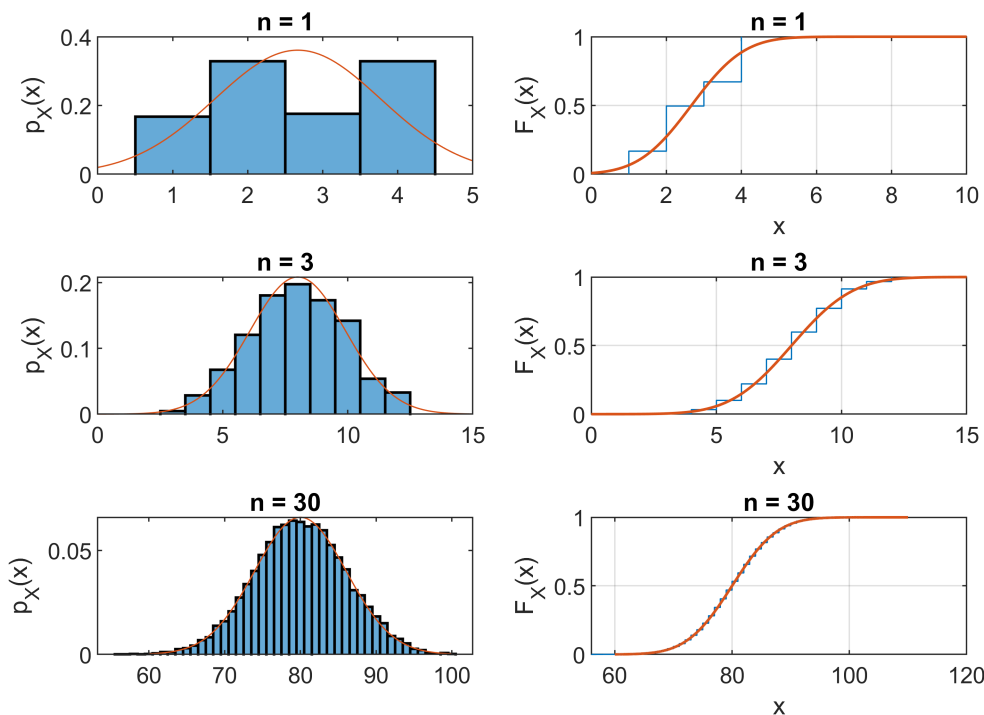
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close all;
figure
s(1) = subplot(3,2,1) ;
    histogram(Sn(1,:), 'Normalization', 'pdf', LineWidth=1);
    hold on;
    x = 0:0.01:5;
    plot(x, Gaussian_n_1.pdf(x));
    hold off;
    title(s(1), 'n = 1')
    ylabel("p_X(x)")
s(2) = subplot(3,2,2) ;
    cdfplot(Sn(1,:))
    hold on;
    x = 0:0.01:10;
    plot(x, Gaussian_n_1.cdf(x), LineWidth=1);
    hold off;
    title(s(2), 'n = 1')
    ylabel("F_X(x)")
s(3) = subplot(3,2,3);
    histogram(Sn(3,:), 'Normalization', 'pdf', LineWidth=1)
    hold on;
    x = 0:0.01:15;
    plot(x, Gaussian_n_3.pdf(x));
    hold off;
    title(s(3), 'n = 3')
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ylabel("p_X(x)")
s(4) = subplot(3,2,4);
cdfplot(Sn(3,:))
hold on;
x = 0:0.01:15;
plot(x,Gaussian_n_3.cdf(x),LineWidth=1);
hold off;
title(s(4),'n = 3')
ylabel("F_X(x)")
s(5) = subplot(3,2,5);
histogram(Sn(30,:), 'Normalization', 'pdf', LineWidth=1)
hold on;
x = 60:0.01:100;
plot(x,Gaussian_n_30.pdf(x));
hold off;
title(s(5),'n = 30')
ylabel("p_X(x)")
s(6) = subplot(3,2,6);
cdfplot(Sn(30,:))
hold on;
x = 60:0.01:110;
plot(x,Gaussian_n_30.cdf(x),LineWidth=1);
hold off;
title(s(6),'n = 30')
ylabel("F_X(x)")
sgtitle({'Superimposed PDF and CDF with same mean and varince as S_n for n\in \{1, 3, 30\}'}, "I

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Superimposed PDF and CDF with same mean and varince as  $S_n$  for  $n \in \{1, 3, 30\}$



%Again, we observed that when  $n$  is increased,  $S_n$  looks more like a gaussian

%distribution as we expect from CLT.