

Example Indicator Function

```
k = 500; % number of points on pdf and cdf plot

beta=8;

n=10;
%exponential density
y1=[0:k]'./10;
fy=exp pdf(y1,beta);
x=exprnd(beta,n,1);

y=(x>2);
p0=exp cdf(2,beta);
p1=1-p0;

figure
subplot(2,2,1)
histogram( x,'Normalization','pdf','NumBins',15 );
hold on

line(y1,fy,'Color','Red')
title( {'Sample Distribution';['X \sim Exp',num2str(beta)]; ['n=',
num2str(n)]} );

subplot(2,2,2)
tb1=tabulate(y);

t = cell2table(tb1,'VariableNames', ...
    {'Value','Count','Percent'});
t.Value = categorical(t.Value);

bar(t.Value,t.Count./sum(t.Count))

%histogram( y,'Normalization','pdf','BinEdges',[-.05,.05,.95,1.05]
);
title( {'Sample Distribution';['I(X>2)']; ['n=', num2str(n)]} );
hold on
plot(t.Value,[p0 p1], '*', 'Color','red')
legend('Observed','Expected', 'Location','northwest')
legend("boxoff")

%%%%%%%%%%%%%%
n=100;
%exponential density
```

```

y1=[0:k]'./10;
fy=exp pdf(y1,beta);
x=exprnd(beta,n,1);

y=(x>2);
p0=exp cdf(2,beta);
p1=1-p0;

figure
subplot(2,2,1)
histogram( x,'Normalization','pdf' );
hold on

line(y1,fy,'Color','Red')
title( {'Sample Distribution';['X \sim Exp',num2str(beta)]; ['n=',
num2str(n)]} );

subplot(2,2,2)
tb1=tabulate(y);

t = cell2table(tb1,'VariableNames', ...
    {'Value','Count','Percent'});
t.Value = categorical(t.Value);

bar(t.Value,t.Count./sum(t.Count))

title( {'Sample Distribution';['I(X>2)']; ['n=', num2str(n)]} );
hold on
plot(t.Value,[p0 p1], '*', 'Color','red')

legend('Observed','Expected','Location','northwest')
legend("boxoff")
%%%%%%%%%%%%%%

n=1000;
x=exprnd(beta,n,1);

y=(x>2);

subplot(2,2,3)
histogram( x,'Normalization','pdf' );
hold on

line(y1,fy,'Color','Red')
title( {'Sample Distribution';['X \sim Exp',num2str(beta)]; ['n=',
num2str(n)]} );

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subplot(2,2,4)

tb1=tabulate(y);

t = cell2table(tb1,'VariableNames', ...
    {'Value','Count','Percent'});
t.Value = categorical(t.Value);

bar(t.Value,t.Count./sum(t.Count))

title( {'Sample Distribution';['I(X>2)']; ['n=', num2str(n)]} );
hold on
plot(t.Value,[p0 p1], '*', 'Color','red')

legend('Observed','Expected', 'Location','northwest')
legend("boxoff")

figure
n=10;
nsim=1000;

for i=1:nsim
x=exprnd(beta,n,1);
yy(i)=(mean(x>2));
end;

teoreticprob=1-expcdf(2,beta);
subplot(2,2,1)
histogram( yy,'Normalization','pdf' );
mu=teoreticprob;
sigma=mu*(1-mu)./n;
xnew=linspace(mu-2.5*sqrt(sigma),mu+2.5*sqrt(sigma), k);

line(xnew, normpdf(xnew,mu,sqrt(sigma)), 'Color','red')
title({'Sampling Distribution';['Sample mean of I(X>2) n=' ,
num2str(n)];['nsim=',num2str(nsim)]})

n=100;
nsim=1000;
y=zeros(nsim,1);
for i=1:nsim
x=exprnd(beta,n,1);
yy(i)=(mean(x>2));
end;

```

```

teoreticprob=1-expcdf(2,beta);
subplot(2,2,2)
histogram( yy,'Normalization','pdf' );
mu=teoreticprob;
sigma=mu*(1-mu)./n;
xnew=linspace(mu-2.5*sqrt(sigma),mu+2.5*sqrt(sigma), k);

line(xnew, normpdf(xnew,mu,sqrt(sigma)),'Color','red')
title({'Sampling Distribution';['Sample mean of I(X>2) n=' ,
num2str(n)];['nsim=',num2str(nsim)]})

y=zeros(nsim,1);
for i=1:nsim
x=exprnd(beta,n,1);
yy(i)=(mean(x>2));
end;

teoreticprob=1-expcdf(2,beta);
subplot(2,2,3)
histogram( yy,'Normalization','pdf' );
mu=teoreticprob;
sigma=mu*(1-mu)./n;
xnew=linspace(mu-2.5*sqrt(sigma),mu+2.5*sqrt(sigma), k);

line(xnew, normpdf(xnew,mu,sqrt(sigma)),'Color','red')

title({'Sampling Distribution';['Sample mean of I(X>2) n=' ,
num2str(n)];['nsim=',num2str(nsim)]})

n=10000;
nsim=1000;
y=zeros(nsim,1);
for i=1:nsim
x=exprnd(beta,n,1);
yy(i)=(mean(x>2));
end;

teoreticprob=1-expcdf(2,beta);
subplot(2,2,4)
histogram( yy,'Normalization','pdf' );
mu=teoreticprob;
sigma=mu*(1-mu)./n;
xnew=linspace(mu-2.5*sqrt(sigma),mu+2.5*sqrt(sigma), k);

line(xnew, normpdf(xnew,mu,sqrt(sigma)),'Color','red')

```

```
title({'Sampling Distribution';['Sample mean of  $I(X>2)$  n=' ,  
num2str(n)];['nsim=',num2str(nsim)]})
```