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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%
% CODE CHALLENGE 2 - Monte Carlo Analysis
%
% The purpose of this challenge is to perform a Monte-Carlo analysis
 on the
% lift generated by an aircraft.  The aircraft has the following
 characteristics:
%   Wing surface area, S = 80 m^2
%   Lift coefficient, C_L = 0.90 +- 0.03
%
% And is flying under the following conditions
%   Air density, rho = 0.653 kg/m^3
%   Airspeed, V = 100 +- 10 m/s
%
%
 -------------------------------------------------------------------------
%
% To complete the challenge, execute the following steps:
% 1) Sample S, C_L, rho, and V 10,000 times.
% 2) Calculate lift in kilonewtons for each of the 10,000 samplings/
simulations.
% 3) Calculate the best estimate and error for lift and report it to
 the
% command window using appropriate significant figures.
% 4) Plot a histogram of L.
% Bonus 1) Calculate drag in kilonewtons for each of the 10,000
% samplings/simulations.
% Bonus 2) Make a scatterplot of Lift vs Drag.
%
% NOTE: DO NOT change any variable names already present in the code.
%
% Upload your team's script to Canvas to complete the challenge.
%
% NAME YOUR FILE AS Challenge2_Sec{section number}_Group{group
 breakout #}.m
% ***Section numbers are 1 or 2***
% EX File Name: Challenge2_Sec1_Group15.m
%
%
```

```
% 1) Zak Reichenbach
% 2) Rion Rohac (Never really showed up or make contact)
% 3) Reid Godbey (In first group out group meeting silently)
% 4) Nathan Tonella
% 5) Jae Jung
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%
```

Housekeeping

(Please don't "clear all" or "clearvars", it makes grading difficult)

```
close all   % Close all open figure windows
clc         % Clear the command window
```

1) Sample S, C_L, rho, and V 10,000 times

(i.e. the S variable should contain 10000 samples of the wing surface area)

```
N = 1e04;
S = zeros(N,1)+80;
C_L = .90 + .06*randn(N,1)-.03;
rho = zeros(N,1) + .653;
V = 100 + (20*randn(N,1)-10);
```

2) Calculate lift in kilonewtons for each of the 10,000 samplings/simulations.

Given that the equation for lift is: L = 0.5 * rho * V^2 * C_L * S (Newtons)

```
L = round(.5.*rho.*V.^2.*C_L.*S)/1000; % (KiloNewtons)
```

3) Calculate the best estimate and error for lift

Report it to the command window using appropriate significant figures.

```
V_best = mean(V);
stdV = 2*(10/V_best);
stdLC = .03/mean(C_L);

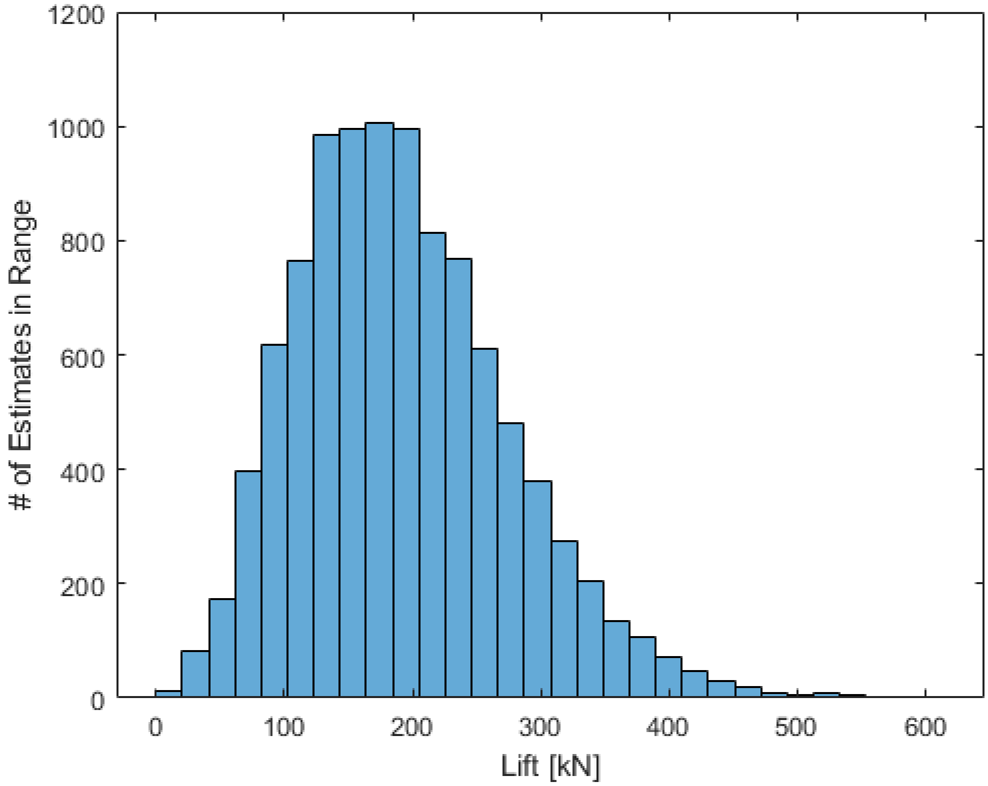
L_best = mean(L);
L_err  = sqrt(stdV.^2+stdLC^2);
```

4) Plot a histogram (use the "histogram" command) of L with 30 bins.

Add annotations and labels for style points!

```
figure(1)
histogram(L,'NumBins',30);
```

```
xlabel('Lift [kN]');
ylabel('# of Estimates in Range')
```



Bonus 1) Calculate drag in kilonewtons

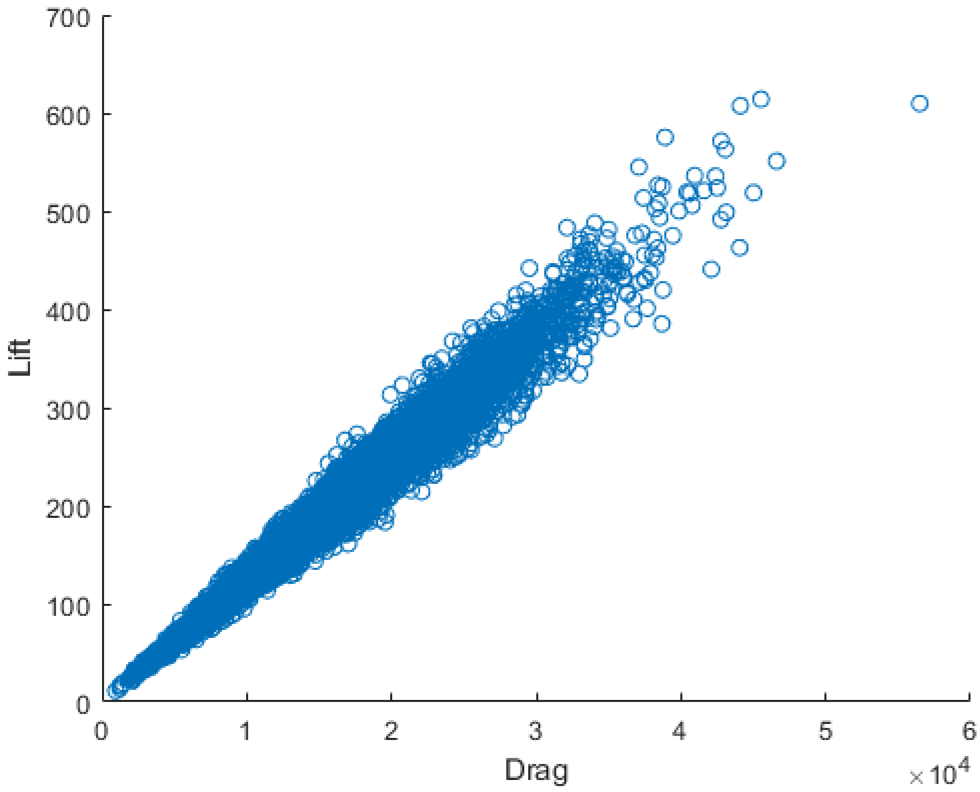
For each of the 10,000 samplings/simulations, given that the equation for drag is: D = 0.5 * rho * V^2 * C_D * S (Newtons) and that C_D = vnb n n70 +- 0.005

```
C_D = 70;
D = (0.5 .* rho .* V.^2 .* C_D .* S)./1000; %(KiloNewtons)
```

Bonus 2) Make a scatterplot of Lift vs Drag.

```
figure(2)
scatter(D,L)
xlabel('Drag')
ylabel('Lift')
% Think about the following (no work to do):
%     - Why do you think the points are spread into an ellipse and not
 a
%     circle?
%     - What is the significance of the general trend/slope of the
 data?
%     - How could this sort of analysis be useful when dealing with
 more
```

```
%     complicated systems and equations?
```



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