Group homework 2

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```matlab
% Problem 1
n=1e6
y = 15*rand(n,1)+2;
x = 3*rand(n,2)-1;
x(:,1) = 15 + x(:,1);
x(:,2) = 30 + x(:,2);
latetime=8
Ttot= @(n) (x(:,1)-y).*(x(:,1)>=y) + (x(:,2)-y).*(x(:,1)< y);
disp('Problem 1')
disp(['the confidence interval is '])
disp([binomialCI(n,sum(Ttot(n) > latetime))]);

% Problem 3
disp('Problem 3')
[mean_g, out] = meanMC_g(@(n1) MonteCarloOptions(n1), .02)

% Problem 5
n2=1e3;
alp=2;
bet=2;
beta_x=(gamma(alp)*gamma(bet))/gamma(alp+bet);
rhox= @(x) (1/beta_x).*(x.^(alp-1)).*(1-x).^(bet-1);
rhoz=1;
%c=1 over the max of rhox/rhoz from x: 0 to 1
c=1/1.5;
% generate 1.6 * n samples since 1.6 > 1/ c
XU=rand(1.6*n2,2);
% check if Ui < c*(rhox/rhoz)
keep=XU(:,2)<=(c*rhox(XU(:,1)));
grab=XU(keep==1,1);
disp('Problem 5')
grab=grab(1:n2);
disp(length(grab))
disp('The length of the vector grab is 1000, which contains the 1000 accepted random variables')
disp('To verify: The mean is:')
disp(mean(grab))
disp('The variance is:')
disp(var(grab))

function y= MonteCarloOptions(n)
    rng(1,"twister");
    z=normrnd(0,1,2,n);
    A= [2^(1/2)/2 0; 2^(1/2)/2 2^(1/2)/2 ];
    S1= @(n) 100*exp((-.0225)+.3*n);
    S2 = @(n) 100*exp(-.045 + .3*n);
    Ax = A*z;
    g = max(1/2*(S1(Ax(1,:))+S2(Ax(2,:)))-100, 0);
```

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        y = sum(g)/n
end
```

n =

    1000000

latetime =

    8

Problem 1
the confidence interval is
    0.4651   0.4677

Problem 3

y =

    0

Warning: Yrand should be a random variable vector of length n, but not an
integrand or a matrix. Now GAIL is using the default Yrand =@(n)
rand(n,1).^2.

mean_g =

    0.3282

out =

  struct with fields:

        Yrand: @(n)rand(n,1).^2
       abstol: 0.0200
       reltol: 0.1000
    bound_err: [0.0709 0.0321]
        alpha: 0.0100
        fudge: 1.2000
          tau: 2
          hmu: [0.3376 0.3314]
         time: 0.0226
           n1: 10000
         nSig: 10000
            n: [10000 12028]
      nremain: 999967960
      nbudget: 1.0000e+09
         ntot: 32040
      tbudget: 100
          var: 0.0878
      kurtmax: 5.6915
```

```
    exitflag: 0

Problem 5
        1000

The length of the vector grab is 1000, which contains the 1000 accepted random
 variables
To verify: The mean is:
    0.5049

The variance is:
    0.0530
```

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