
Question1 (10 points)

Julia should be the only computer language you used in this question,

$$f_{Y|X} \propto \exp\left(-\frac{(x-y)^2}{2}\right) \times \frac{1}{1+y^2}$$

(a) (2 points) Implement a grid approximation for the above problem.

(b) (2 points) Complete the following table using your grid approximation.

Grid size n	50	250	750	1500	3000
$\mathbb{E}[Y \mid X = 0.5]$					

(c) (2 points) Implement a direct sampling scheme using your grid approximation.

(d) (2 points) Complete the following table using your grid approximation.

Grid size n	50		250		750		1500		3000	
Sample size m	100	1000	100	1000	100	1000	100	1000	100	1000
$\mathbb{E}[Y \mid X = 0.5]$										

(e) (2 points) Consider and use the following grid without transforming Y.

```
julia> x = 0.5; a = -5; b = 5;
julia> if n <= 100
           y_grid = collect(
               range(a, length=n, stop=b));
           newa = a;
       elseif n > 1000 && n <= 2000
           nm = 1000;
           na = round(Int, (n-nm)/2);
           l = (b - a)/(nm-1);
           newa = a - l*na;
           y_grid = collect(
               range(newa, step=l, length=n));
       else n > 2000
           nm = round(Int, n/2);
           na = round(Int, (n-nm)/2);
           l = (b - a)/(nm-1);
           newa = a - l*na;
           y_grid = collect(
               range(newa, step=l, length=n));
       end
```

Complete the following table and compare it with the one in part (b).

Grid size n	50	250	750	1500	3000
$\mathbb{E}[Y \mid X = 0.5]$					