1 Student Details

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2 Question for student K1234

Write a function `answerProblem` which returns two values `part1` and `part2` where these values are a Monte Carlo approximation to the integrals

$$\texttt{part1} \approx \int_0^{\frac{\pi}{2}} \cos(x)\mathrm{d}x$$

and

$$\texttt{part2} \approx \int_0^1 \exp(x)\mathrm{d}x.$$

Use 1000000 samples for your calculation.

3 Answer

Let u_1, u_2, $\ldots u_n$ be uniformly distributed on the interval $[0, 1]$ then we can estimate the integral of $f(x)$ using the formula

$$\frac{(b-a)}{n}\sum_{i=1}^{n} f(a + (b-a)u_i).$$

Implementing this in MATLAB we find that

$$\texttt{part1} = \int_0^{\frac{\pi}{2}} \cos(x)\mathrm{d}x \approx 1.0002.$$

$$\texttt{part2} = \int_0^1 \exp(x)\mathrm{d}x \approx 1.7817.$$

I tested the code by writing a general Monte Carlo integrator that worked for any f. I then tested this general function using the analytic formula

$$\int_0^1 x^2\mathrm{d}x = \frac{1}{3} \approx 0.3333.$$