Lebovitz_HW1

Shay Lebovitz

4/11/2020

Problem #1

1a – int(1->3) $x/(1+x^2)^2$ dx. We can sample from Unif[1,3] and apply it to the function. Since the density of the uniform dist. is 1/2, we must multiply by two. The real answer is 0.2

```
n <- 100000
x <- runif (n, min = 1, max = 3)
f <- function (x) {2*x/(1+x^2)^2}
mean (f (x))
```

```
## [1] 0.199979
```

1b – int (-inf -> inf) $x^2 \exp(-x^2)$ dx. Choose the normal distribution, as it's domain is (-inf,inf) and follows a similar format. Because the normal distribution has a 1/sqrt(2*pi) term, we must multiply by that. Similarly, we must include an $\exp(-x^2/2)$ to acheive the desired equation. The real answer is sqrt(pi)/2 = 0.88622…

```
n <- 100000
x <- rnorm (n)
f <- function (x) {
        x^2*sqrt(2*pi)*exp(-x^2/2);
}
mean(f(x))
```

```
## [1] 0.8848241
```

1c – int(-1, 1) int (-1, 1) |x-y| . We can sample from Uniform [-1,1]X[-1,1] distributions. Because both the marginal densities are 1/2, we must multiply by 4. The real answer = 8/3 = 2.6666

```
n = 100000
x = runif (n, min = -1, max = 1)
y = runif (n, min = -1, max = 1)
mean (4*abs(x-y))
```

```
## [1] 2.656278
```

Problem #2

```
n <- 100000
x <- rlnorm (n)
eN <- rnorm (n)
y <- x^3*exp(9+eN)
mean (y/x)
```

```
## [1] 94331.42
```