ECE 131A HW 3

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Problem 1

Then this must be a geometric distribution, so the pmf would be

$$p(Y = y) = (1 - p)^{y-1}p$$

Problem 2

(a)

(b)

Problem 3

(a)

we have

$$k\int_0^1 x^2(1-x)^2dx = 1$$

$$k\int_0^1 x^2 - 2x^3 + x^4dx = 1$$

$$k\left[\frac{x^3}{3} - \frac{2x^4}{4} + \frac{x^5}{5}\right]_0^1 = 1$$

$$k\left(\frac{1}{3} - \frac{2}{4} + \frac{1}{5}\right) = 1$$

$$\boxed{k = 30}$$

(b)

$$\begin{aligned} P(X \geq \frac{3}{4}) &= 30\int_{\frac{3}{4}}^1 x^2(1-x)^2dx \\ &= 30\left[\frac{x^3}{3} - \frac{2x^4}{4} + \frac{x^5}{5}\right]_{\frac{3}{4}}^1 \\ &= \boxed{0.103515625} \end{aligned}$$

Problem 4

(a)

Let the price of gas be a random variable X, then we have that the total cost $Y = 12X + 1$, thus

$$E[Y] = E[12X + 1] = 12E[X] + 1 = 12 \cdot 4.40 + 1 = \boxed{53.8}$$

(b)

We have

$$\text{Var}(X) = 12^2\text{Var}(Y) = 12^2\left(\frac{1}{12}(0.2)^2\right) = 0.48$$

Problem 5