

Exercise-1.5: We need to show $E[(f(x) - E[f(x)])^2] = E[f(x)^2] - E[f(x)]^2$

To do this first we have to know for any random variables X and Y $E[X+Y] = E[X] + E[Y]$ and $E[aX] = aE[X]$ where a is constant. We will reach to the solution by expanding the square. We could use the definition of expectancy too.

$$\begin{aligned} E[(f(x) - E[f(x)])^2] &= \\ E[f(x)^2 - 2f(x)E[f(x)] + E[f(x)]^2] &= \\ E[f(x)^2] - 2E[f(x)E[f(x)]] + E[f(x)]^2 &= \\ E[f(x)^2] - 2E[f(x)]^2 + E[f(x)]^2 &= \\ E[f(x)^2] - E[f(x)]^2 \end{aligned}$$