# Handout for Lecture 9 <br> Distribution, Expectation, Variance 

ECON 340: Economic Research Methods
$X$ is a random variable.

- Expectation of $X, \mu_{X}=E(X)=\sum_{x} x f(x)$
- Variance of $X, \sigma_{X}^{2}=\operatorname{Var}(X)=E\left[\left(X-\mu_{X}\right)^{2}\right]=\sum_{x}\left(x-\mu_{X}\right)^{2} f(x)$
- Standard deviation of $X, \sigma_{X}=\sqrt{\sigma_{X}^{2}}$

If $X$ is a random variable and $Y=a+b X$, then $Y$ is also a random variable with

- $E(Y)=a+b E(X)$
- $\operatorname{Var}(Y)=b^{2} \operatorname{Var}(X)$

You are at a fair and considering playing the following game - flip a coin, if you get heads, you gain $\$ 10$, else you lose $\$ 10$. Denote $X$ as your winnings/loss from the game.

1. Find the expected value, variance, and standard deviation of $X$.
2. You look up and realize that you have to pay $\$ 5$ in order to play the game. So your actual winnings/loss from the game will be $Y=X-5$. Find the expected value, variance, and standard deviation of $Y$.
3. You see another stall offering a lower stakes game - flip a coin, if you get heads, you gain $\$ 5$, else you lose $\$ 5$. Your winnings/loss from this game will be $Z=0.5 X$. Find the expected value, variance, and standard deviation of $Z$.
