2/19/26 Announcements

- HW3 Due Today 11:59 PM on Icon
- Quiz 3 Today in Discussion
- To find discussion notes github.com/tyler3schmidt/STAT1300

1)

Sally's seashell company has a fixed cost of 25$ an hour. Her possible hourly revenue is

- $15 35% of the time
- $30 40% of the time
- $40 25% of the time

Define the random variable representing her Profit & Loss and determine its expected value.

(ans)

(a) The random variable is

X	-10	5	15
$P(X=x)$	0.35	0.40	0.25

Then to find its expected value,

$$E(X) = \sum x_i P(X = x_i)$$

$$= (-10)(0.35) + (5)(0.40) + (15)(0.25)$$

$$= -3.5 + 2 + 3.75$$

$$= 2.25$$

2) Each of sally's seashels have a 6% chance of being defective
(a) What is the probability her first defect is on the 8-th seashell.
(b) If she gathers 20 seashells what is the probability 2 are defective?
(ans)

(a) Recognize first, so we use the geometric distribution

$P(X=x|p) = (1-p)^{x-1} p$

We are given $p = 0.06$, $x = 8$

So

$$P(X=8) = (1-0.06)^{8-1}(0.06)$$
$$= (0.94)^7 (0.06)$$
$$= 0.0389$$

(b) Notice a fixed $n = 20$ are we are asked for the probability $X = x$. This is a binomial distribution,

$$P(X=x \mid n,p) = \binom{n}{x} p^x (1-p)^{n-x}$$

In this case $n=20$, $p=0.06$, and $x=2$. Therefore

$$P(X=2 \mid n,p) = \binom{20}{2} (0.06)^2 (1-0.06)^{20-2}$$
$$= (190)(0.06)^2 (0.94)^{18}$$
$$= 0.2246$$

3) A different day Sally gathers 50 seashells. What is the probability that at least one is defective?

(a) 0.934 (b) 0.955

(c) 0.988

(ans)

Recall

P(At least one) = 1 − P(none)

Now we use the Binomial distribution to find P(none).

That is, $x=0$, $n=50$, $p=0.06$.

$$P(X=0) = \binom{50}{0}(0.06)^0(0.94)^{50}$$

$$= 0.045$$

Hence

P(At lenst one) = 1 − 0.045

= 0.955

4) If sally gathers 50 seashells what is the expected number of defects?

(a) 3 (b) 50

(c) 6

(ans)

The expected value of the Binomial Distribution is

$E(X) = np$

In this case $n = 50$,

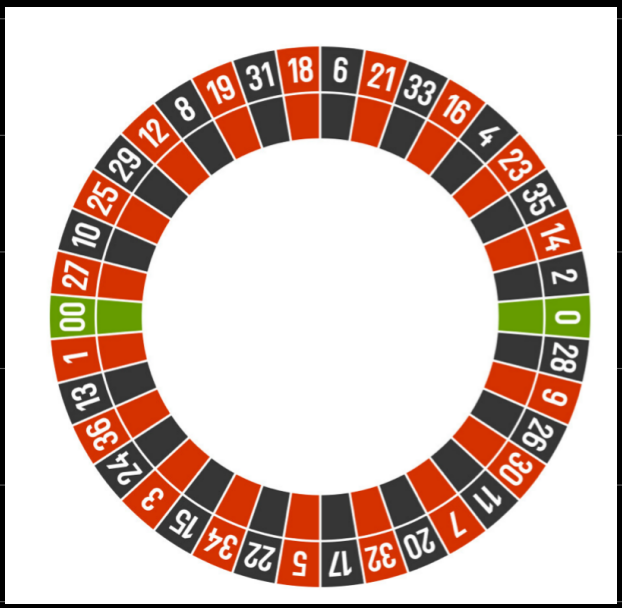
$P = 0.06$, which implies

$E(X) = (50)(0.06)$

$= 3$

5)

Given the Roulette wheel with 38 slots (18 red, 18 black, 2 0's)



If you bet $1 on red / black one win $2 if correct. Define the random variable that represents your profit / loss

and find its expected value (ans)

The random variable is

X	-1	1
$P(X=x)$	$20/38$	$18/38$

Then the expected value is

$$E(X) = \sum x_i P(X = x_i)$$

$$= -1(20/38) + 1(18/38)$$

$$= -20/38 + 18/38$$

$$= -2/38$$