Chapter 17 Exercise Set A

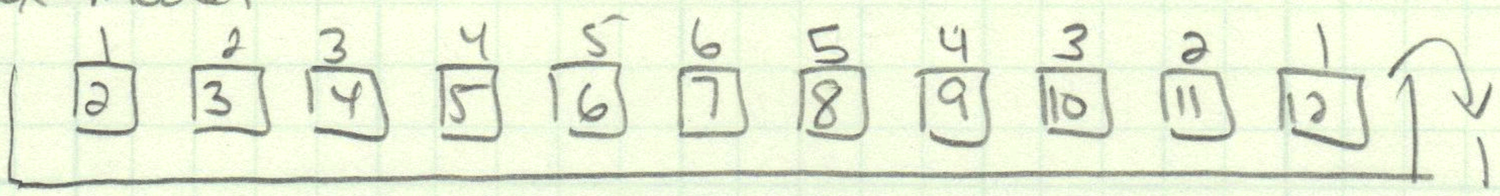
1 **a** $box_{ave} = 2$ $2 \times 100 = 200$

b $box_{ave} = -1/4$ $-1/4 \times 100 = -25$

c $box_{ave} = 0$ $0 \times 100 = 0$

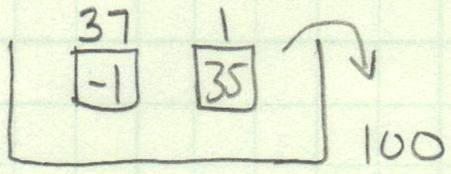
d $box_{ave} = 2/3$ $2/3 \times 100 = 67$

2 box model:



$box_{ave} = 7$ $7 \times 1 = 7$

3 box model:

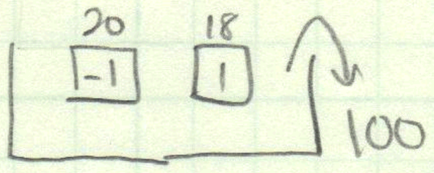


$box_{ave} = -.05$

$EV_{sum} = -.05 \times 100 = -\$5$

Box model comes from pg 282 where it states, betting on a single number pays $35 to $1.

4 box model



Pay even means you gain a dollar or lose a dollar.

$box_{ave} = -.05$

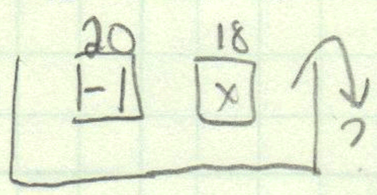
$EV_{sum} = -.05 \times 100 = -\$5$

5

$box_{ave} = -.05$

$EV_{sum} = -.05 \times 1{,}000 = -\$50$

6 box model:



Weird problem. ☺

We want $box_{ave} = 0$

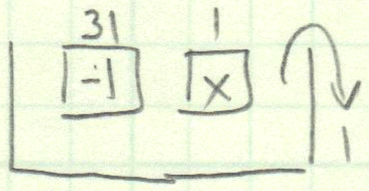
$20(-1) + 18x = 0$

$-20 + 18x = 0$

$18x = 20$

$x = 20/18 = \$1.11$

7 box model



We want the boxave to be equal to zero for it to be fairr.

$$-1(31)+1(x)=0$$
$$-31+x=0$$
$$x=\$31$$

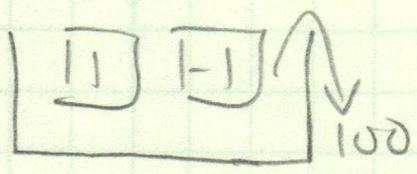
Chapter 17 Exercise Set B

1a $box_{ave} = 4$ $EV_{sum} = 100 \times 4 = 400$

$box_{SD} = 2$ $SE_{sum} = \sqrt{100} \times 2 = 20$

1b 400 give or take 20 or so.

1c 400; 20

2 

$box_{ave} = 0$ $EV_{sum} = 100 \times 0 = 0$

$box_{SD} = 1$ $SE_{sum} = \sqrt{100} \times 1 = 10$

Net gain = \$0 give or take +\$10.

3 We want a list that has an average of about 50 and spread of 2 SE's above and below or $5(2) = 10$; a range of 40 - 60.

i seems to fit that criteria.

4 $box_{ave} = 3$ $3 \times 50 = 150 = EV_{sum}$.

$box_{SD} = 1.41$ $1.41 \times \sqrt{50} = 10 = SE_{sum}$.

$EV_{sum} = 150$ Expected = 157 Chance error: $150 - 157 = 7$

$SE_{sum} = 10$.

5 We are increasing the number of draws by a factor of 4. So:

Multiply the EV by four: $50 \times 4 = 200$

Multiply the SE by $\sqrt{4} = 2 \times 10 = 20$

6a True $box_{ave} = \underline{3} \times 100 = 300 = EV_{sum}$

6b True $box_{SD} = 2 \times \sqrt{100} = 20 = SE_{sum}$

6c False This doesn't take in to consideration chance error!

6d True by definition

7 Yes, The chance is very small but still exists Look at Normal curve for $z = 3.0$

Chapter 17 Exercise Set C

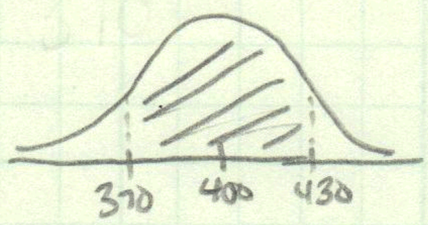
1a All 1's = $1 \times 100 = 100$
All 4's = $4 \times 100 = 400$

1b $box_{ave} = 2$ $box_{SD} = 1$ $EV_{SUM} = 2 \times 100 = 200$ $SE_{SUM} = 1 \times \sqrt{100} = 10$ 200 give or take 10 or so

1c Over 5 SE's away! Almost 0% chance

2a All 1's = $1 \times 100 = 100$
All 9's = $9 \times 100 = 900$

2b $box_{ave} = 4$ $box_{SD} = 3$ $EV_{sum} = 4 \times 100 = 400$ $SE_{sum} = 3 \times \sqrt{100} = 30$



$\frac{370 - 400}{30} = -1$

$\frac{430 - 400}{30} = 1$

> 68% in middle

3a You want a high absolute chance error because EV = 0, choose a lot of draws - 100

3b Same as above

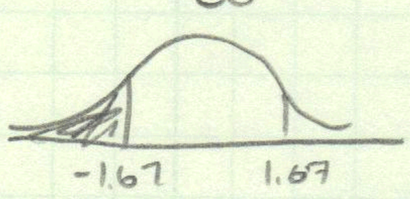
3c You want a low absolute chance error because EV = 0, choose low # of draws - 10

4 i) $box_{ave} = 5$ $box_{SD} = 3$ $EV_{sum} = 100 \times 5 = 500$ $SE_{sum} = \sqrt{100} \times 3 = 30$

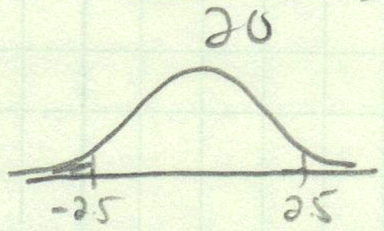
ii) $box_{ave} = 20$ $box_{SD} = 4$ $EV_{sum} = 20 \times 25 = 500$ $SE_{sum} = 4 \times \sqrt{25} = 20$

a The z score will be lower with box i

i) $\frac{550 - 500}{30} = 1.67$



ii) $\frac{550 - 500}{20} = 2.5$

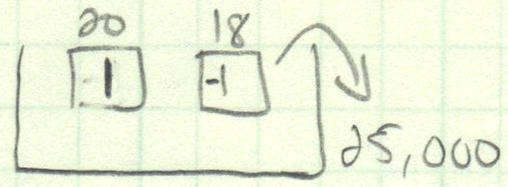


↑ bigger area choose box i.

b Same as a choose box ii

4 c The z score will be higher with box ii. This leaves more area in the middle.

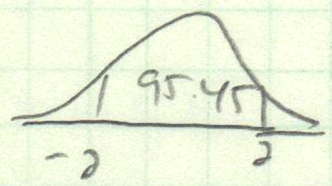
5 box model



$box_{ave} = .05$ $box_{SD} = 1$

$EV_{sum} = 25{,}000 \times .05 = 1315.79$
$SE_{sum} = \sqrt{25{,}000} \times 1 = 157.89$.

$$\frac{1{,}000 - 1315.79}{157.89} = 2 \approx 95.45$$



$$95.45 + \left(\frac{100 - 95.45}{2}\right) \approx 98\%.$$

6 They win and the casino loses $25,000; they lose and the casino gains $25,000 There is almost even odds $\frac{20}{38}$ $\frac{18}{38}$ of either happening so 50%.

7 Winning pays 35 to 1 and he is guaranteed to win for 1 of his bets. So he will gain 35,000 for that number. However each wrong number loses 1,000, there are 37 of those so he loses 37,000. Overall

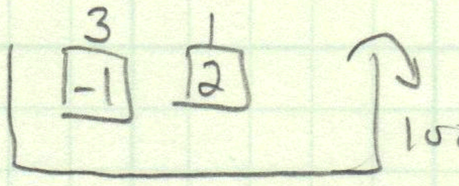
$$35{,}000 - 37{,}000 = -2{,}000 \text{ loss}$$

8 2 is better because the SE will increase but not by a full factor of 2 due to our rule. Since the SE doesn't go up as much the z score will be greater, increasing the percent in the middle.

Chapter 17 Exercise set D

1 a - No $7-(-2)=9$
b - Yes.
c - Yes
d = No the shortcut only applies to 2-number boxes.

2 box model

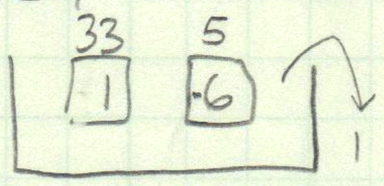


$box_{ave} = -.25$
$SD = 2-(-1)\sqrt{1/4 \times 3/4} = -1.299$

$EV_{sum} = -.25 \times 100 = -\$25$
$SE_{sum} = 1.299 \times \sqrt{100} = \$12.97$

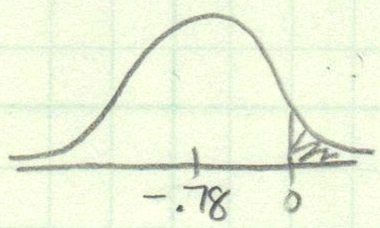
$25 ± $13

3a box model

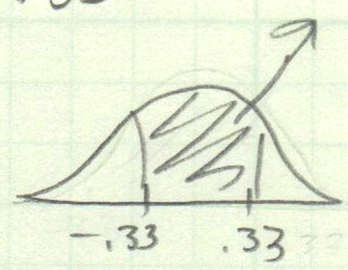


$box_{ave} = .078$ the casino makes 78¢ per dollar played.

3b $EV_{sum} = .078 \times 100 = -\$7.80$
$SD = 6-(-1)\sqrt{5/38 \times 33/38} \approx \$2.37$ (reverse signs in box due to perspective change)

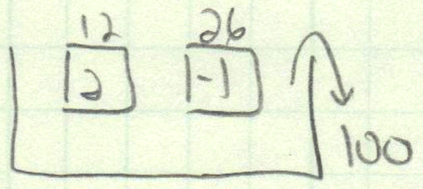


$\frac{0-(-.78)}{2.37} = .33 \approx 27.37$



Tail!
$\frac{100-27.37}{2} = 36.315\%$

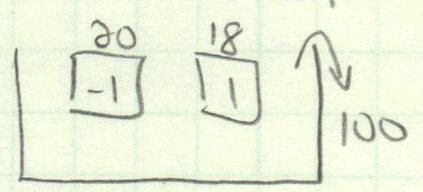
4 i) box model



$box_{ave} = -.05$
$box_{SD} = 1.39$

$EV_{sum} = -.05 \times 100 = -5$
$SE_{sum} = 1.39 \times \sqrt{100} = 13.9$

ii) box model



$box_{ave} = -.05$
$box_{SD} = .999$

$EV_{sum} = -.05 \times 100 = -5$
$SE_{sum} = \sqrt{100} \times .999 = 10$

a False, different SE's will change the chances.

b True, the SE is larger which will make the z score less than ii

c True, same as b.

Chapter 17 Exercise Set E

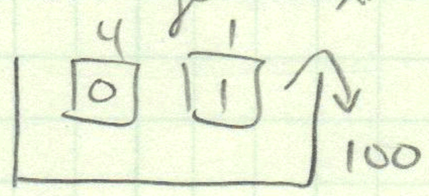
1 a - ii counting box is 1/0

b - $box_{ave} = .5$ $box_{SD} = .5$

$EV_{sum} = .5 \times 16 = 8$
$SE_{sum} = .5 \times \sqrt{16} = 2$

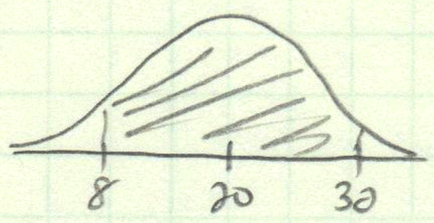
8 give or take 2 or so

2 Change box



$box_{ave} = .2$ $box_{SD} = .4$

$EV_{sum} = .2 \times 100 = 20$
$SE_{sum} = .4 \times \sqrt{100} = 4$

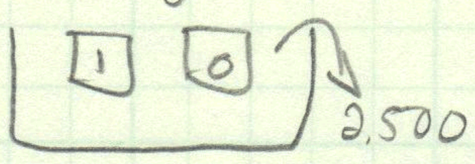


$\frac{8-20}{4} = -3$

$\frac{32-20}{4} = 3$

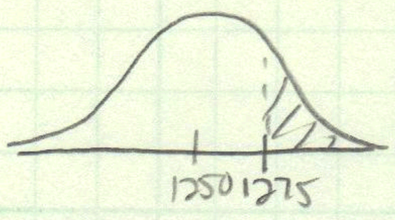
99.730% in the middle

3 Change box



$box_{ave} = .5$ $box_{SD} = .5$

$EV_{sum} = \frac{2500}{} \times .5 = 1250$
$SE_{sum} = \sqrt{2,500} \times .5 = 25$



$\frac{1275-1250}{25} = 1 \approx 68\%$

Tail $\frac{100-68}{2} = 16\%$

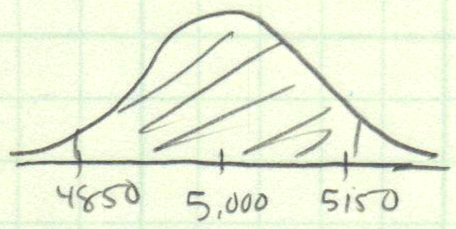
4

Groups of tosses	Obs	Exp	Error	SE
1-100	44	50	-6	5
101-200	54	50	4	5
201-300	48	50	-2	5
301-400	53	50	3	5

Always 100 tosses! $.5 \times \sqrt{100} = 5$

5 That is one SE up and down so 68%.
68 sets were in the interval 45-55.

6a | 1 | 0 | ↺ 10,000



$box_{ave} = .5$ $EV_{sum} = .5 \times 10,000 = 5,000$
$box_{SD} = .5$ $SE_{sum} = .5 \times \sqrt{10,000} = 50$

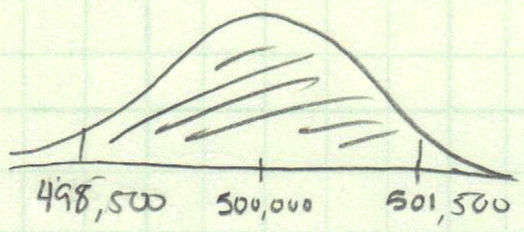
$\frac{4850 - 5000}{50} = -3$

$\frac{5150 - 5000}{50} = 3$

> 99.730% in the middle.

6b box_{ave} / box_{SD} > same as a.

$EV_{sum} = .5 \times 1,000,000 = 500,000$
$SE_{sum} = .5 \times \sqrt{1,000,000} = 500$



$\frac{498,500 - 500,000}{500} = -3$

$\frac{501,500 - 500,000}{500} = 3$

> 99.730% in the middle

7 $box_{ave} = .6$ $EV_{sum} = .6 \times 50 = 30$
$box_{SD} = .49$ $SE_{sum} = .49 \times \sqrt{50} = 3.46$

30, 33, +3, 3.46

8 Make 5 of the tickets 1's and 5 0's; that way the chance of heads is still 50% and tails is 50% too.

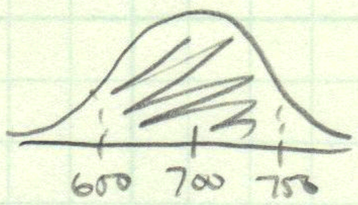
9 Yes, the formula's were correctly used!

Chapter 17 Review Exercises

1a All 1's = $100 \times 1 = 100$
All 10's = $100 \times 10 = 1{,}000$

1b $box_{ave} = 7$ $box_{SD} = 3$

$EV_{sum} = 7 \times 100 = 700$
$SE_{sum} = 3 \times \sqrt{100} = 30$

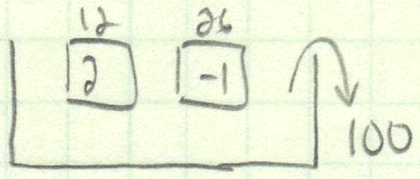


$\frac{650-700}{30} = -1.67 \approx -1.70$

$\frac{750-700}{3} = 1.67 \approx 1.70$

> 91.09% in middle

2a box model

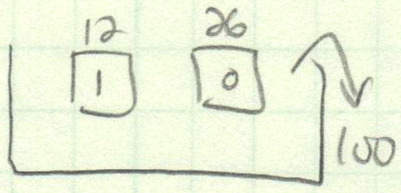


$box_{ave} = -.05$ $box_{SD} = 1.39$

$EV_{sum} = -.05 \times 100 = -\$5$
$SE_{sum} = 1.39 \times \sqrt{100} = \$13.9$

$-\$5 \pm \$13.9$

2b



$box_{ave} = .31$ $box_{SD} = .46$

$EV_{sum} = .31 \times 100 = 31$
$SE_{sum} = .46 \times \sqrt{100} = 4.6$

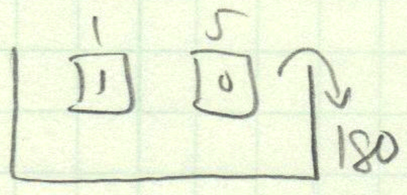
Win 31 times ± 4.6

2c Reading: Keno has a 25% of winning. Roulette has a 18/38 ≈ 31% chance of winning. Keno is worse!

3

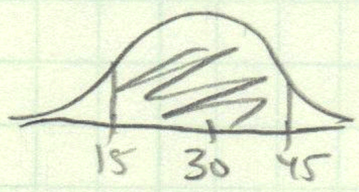
a) iii $1-(-2)=3$
b) i
c) v $1-(-1)=2$ ← 3/4 are -1's; 1/4 are 1's
d) iv 3/4 0's 1/4 1's
e) ii $2-0=2$ ← 1/3 are 2's; 2/3 are 0's.

4



box ave = .167 box sd = .37

$EV_{sum} = .167 \times 180 = 30$
$SE_{sum} = .37 \times \sqrt{180} = 5$



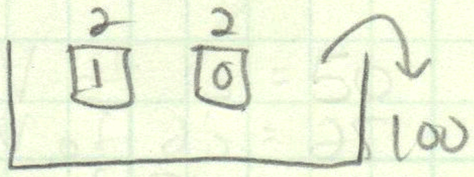
$\frac{45-30}{5} = 3$

$\frac{15-30}{5} = -3$

> 99.730% in the middle

5 We are saying if the ACE is off you pay that amount so pick a low number of draws to minimize it.

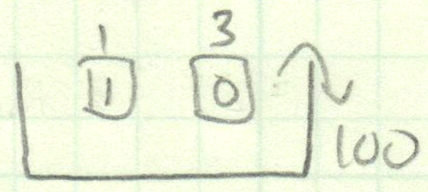
6 Count 1's



$box_{ave} = .5$ $box_{SD} = .5$

$EV_{sum} = .5 \times 100 = 50$
$SE_{sum} = .5 \times \sqrt{100} \times 5$

Count 2's & 3's



$box_{ave} = .25$ $box_{SD} = .43$

$EV_{sum} = .25 \times 100 = 25$
$SE_{sum} = .43 \times \sqrt{100} = 4.3$

12 - Chance error for all #'s $(45-50) + (23-25) + (32-25) = 12$
45 - Obs value of 1's
187 - Obs value for sum of draws $(1 \times 45) + (2 \times 23) + (3 \times 32) = 187$
25 - EV for 3's
50 - EV for 1's
175 - EV for sum $box_{ave} = 1.75$ $1.75 \times 100 = 175 = EV_{sum}$
5 - SE for 1's
32 - Obs value of 3's.

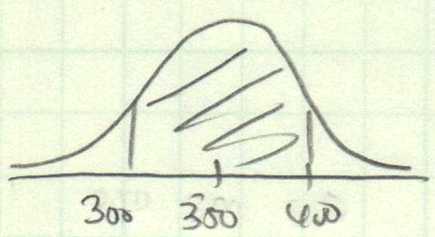
7 a) $321/100 = 3.21$

b) $3.21 \times 100 = 321$

c) for this find that the sum is between 300 & 400

$box_{ave} = 3.5$
$box_{SD} = 1.71$

$EV_{sum} = 3.5 \times 100 = 350$
$SE_{sum} = 1.71 \times \sqrt{100} = 17.1$



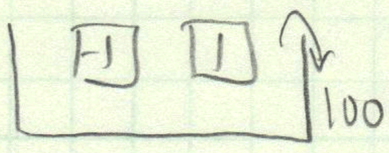
$\frac{300-350}{17.1} = 2.92$

$\frac{400-350}{17.1} = 2.92$

> 99.63% in middle

8a ii because every head adds one and every tails minus' one.

8b

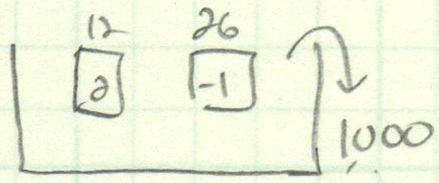


$box_{ave} = 0$
$box_{SD} = 1$

$EV_{sum} = 0 \times 100 = 0$
$SE_{sum} = 1 \times \sqrt{100} = 10$

9

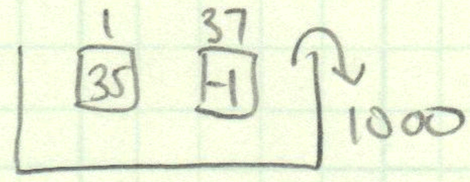
Column



$box_{ave} = .05$ $box_{SD} = 1.39$

$EV_{sum} = .05 \times 1000 = 50$
$SE_{sum} = 1.39 \times \sqrt{1000} = 43.95$

Number



$box_{ave} = .05$ $box_{SD} = 5.76$

$EV_{sum} = .05 \times 1000 = 50$
$SE_{sum} = 5.76 \times \sqrt{1000} = 182.15$

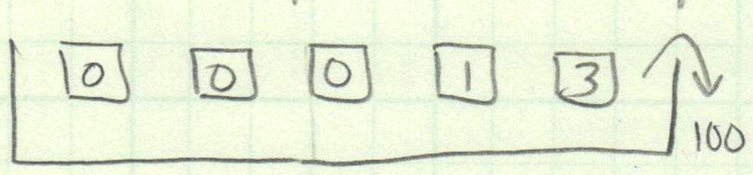
a) False, the different SE's make the z scores different.

b) True, the SE is larger, this makes z decrease and the percent of area in a tail increase.

c) Same as b.

10 They doubled the number of draws & also doubled the sum's. Increasing the # of draws should increase the sums by $\sqrt{\text{factor}}$ in this case $\sqrt{2}$. False

11 SUM (positives only)



$box_{ave} = .8$ $EV_{sum} = .8 \times 100 = 80$
$box_{SD} = 1.17$ $SE_{sum} = \sqrt{100} \times 1.17 = 11.7$

80 give or take 11.7 or so.

12 $box_{ave} = 4$ $EV_{sum} = 4 \times 100 = 400$
$box_{SD} = 2$ $SE_{sum} = 2 \times \sqrt{100} = 20$

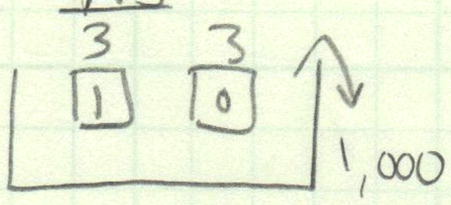
a) 400; 431; 31; 20

b) 400; 386; -14; 20

c) 400; 417; 17; 20

13

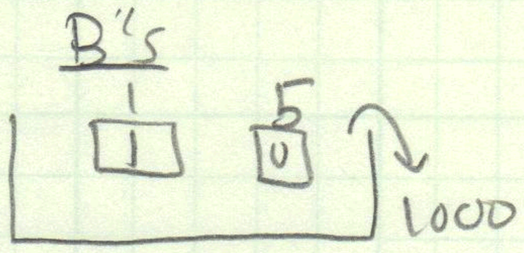
A's



$box_{ave} = .5$
$box_{SD} = .5$

$EV_{sum} = .5 \times 1000 = 500$
$SE_{sum} = .5 \times \sqrt{1000} = 15.8$

B's

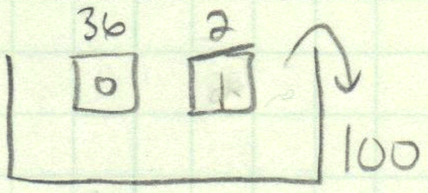


$box_{ave} = .167$
box_{SD} .37

$EV_{sum} = .167 \times 1000 = 167$
$SE_{sum} = .37 \times \sqrt{1000} = 11.7$

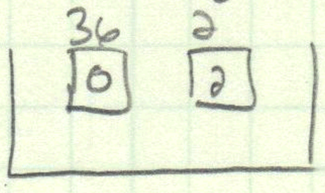
because the SE is larger in A's we want that, it decreases the z score and increases the area in the tail.

14a



$box_{ave} = .05$
$box_{SD} = .22$

14b



$box_{ave} = .10$
$box_{SD} = .44$

Count how often the house wins

$EV_{sum} = .05 \times 100 = 5$
$SE_{sum} = .22 \times \sqrt{100} = 2$

House breaks even if a red/black comes up, but pays each player $1 if green comes up.

$EV_{sum} = .10 \times 100 = \$10$
$SE_{sum} = .44 \times \sqrt{100} = \$4$