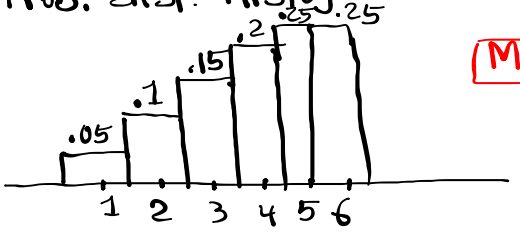
Statistics
Winter 2022
Lecture 10

Live QZ 3

x	$P(x)$
1	.05
2	.1
3	.15
4	.2
5	.25
6	.25

L1 L2

Prob. dist. histogram



Find

$\mu = 4.25$

$\sigma = 1.479$

σ^2 (exact) $= \frac{35}{16} = 2.1875$

1-Var Stats
List: L1
FreqList: L2
Calculate

VARS 5: Statistics 4: σ_x x^2

MATH 1: ▶Frac Enter

Consider a binomial Prob. dist with $n=80$, and $P=.4$

1) $q=1-P=\boxed{.6}$ 2) $\mu=np=80(.4)=\boxed{32}$ 3) $\sigma^2=npq=80(.4)(.6)=\boxed{19.2}$

4) $\sigma=\sqrt{\sigma^2}=\sqrt{19.2}=\boxed{4.382}$

Round μ and σ to a whole number, then find

$\mu=32$ $\sigma\approx 4$

5) 68% Range

$\mu \pm \sigma = 32 \pm 4$

$\Rightarrow \boxed{28 \text{ to } 36}$

6) Usual Range

95% Range

$\mu \pm 2\sigma$

$= 32 \pm 2(4)$

$\Rightarrow \boxed{24 \text{ to } 40}$

Let x be # of Successes, Find

7) P(exactly 35 Successes)

$P(x=35)=$ binompdf(80, .4, 35) $=\boxed{.071}$

8) P(fewer than 30 successes)

$P(x<30)=P(x\leq 29)=$ binomcdf(80, .4, 29) $\boxed{.286}$

9) P(more than 35 successes)

$P(x>35)=P(x\geq 36)=1-P(x\leq 35)=\boxed{.211}$

$=1-$ binomcdf(80, .4, 35)

Don't want | We want

35 36

10) P(between 30 and 40, inclusive, Successes)

$P(30\leq x\leq 40)=$ binomcdf(80, .4, 40) $-$ binomcdf(80, .4, 29) $=\boxed{.687}$

Reduce by 1

We wait on SG 17.

11) $P(x\leq 30 \text{ OR } x\geq 34)$

Add

33 34

$=P(x\leq 30)+P(x\geq 34)$

$=$ binomcdf(80, .4, 30) $+1-$ binomcdf(80, .4, 33)

$=\boxed{.732}$

Prob. dist. with Continuous random Variable:

SG 18-21

$P(x=a)=0$

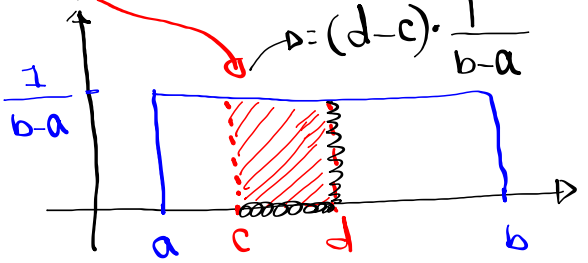
Uniform Prob. dist.

1) Graph is rectangular

2) length $x=a$ to $x=b$.

3) width $\frac{1}{b-a}$

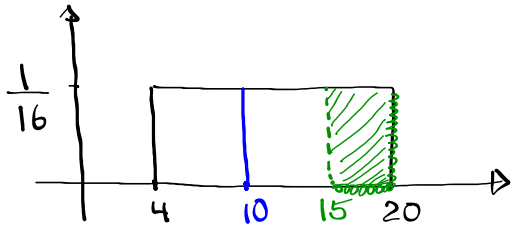
4) $P(c<x<d)$ = Area corresponding to $c<x<d$



Consider a Uniform Prob. dist. for all values from 4 to 20.

$P(x=10)=0$

Line has Zero area.



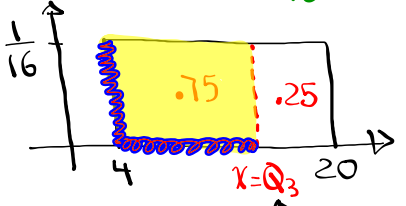
$P(x>15)$

$=(20-15)\cdot\frac{1}{16}=\boxed{\frac{5}{16}}$

Find $x=Q_3$

75% Below

25% above



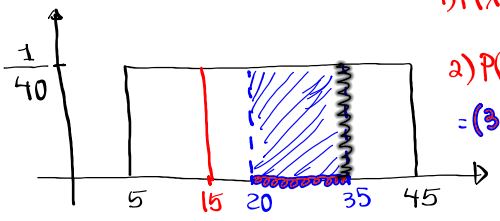
$(x-4)\cdot\frac{1}{16}=.75$

$x-4=16(.75)$

$x=4+16(.75)\rightarrow \boxed{x=16}$

Consider a Uniform Prob. dist for all values from 5 to 45.

1) $P(x=15)=0$

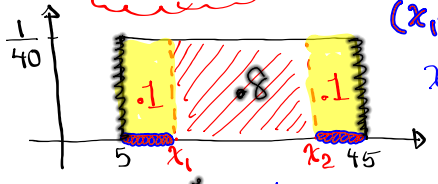


2) $P(20<x<35)$

$=(35-20)\cdot\frac{1}{40}$

$=\frac{15}{40}=\boxed{\frac{3}{8}}$

3) Find two x-values that separate the middle 80% from the rest.



$(x_1-5)\cdot\frac{1}{40}=.1$

$x_1-5=40(.1)$

$x_1=5+4$

$\boxed{x_1=9}$

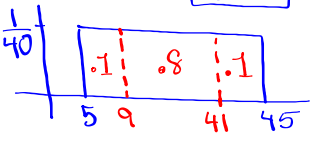
$(45-x_2)\cdot\frac{1}{40}=.1$

$45-x_2=40(.1)$

$45-x_2=4$

$45-4=x_2$

$\boxed{x_2=41}$



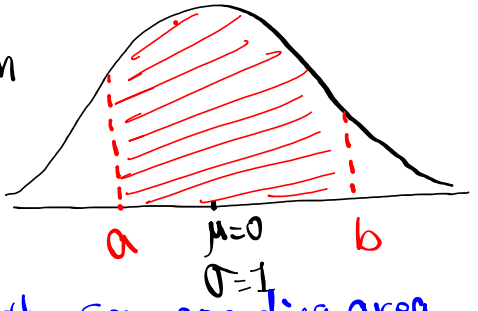
Standard normal Prob. dist:

1) Use variable Z, $P(Z=a)=0$

2) Graph is Symmetric, bell-Shape, with total Area = 1.

3) Mean = Mode = Median

4) $\mu=0$ & $\sigma=1$



5) $P(a<Z<b)$ is the corresponding area within the bell-shape.

2nd | VARS | normalcdf(- - - -

$P(-1 < Z < 1)$

=normalcdf(−1, 1, 0, 1)

Lower: −1 (−) [1]

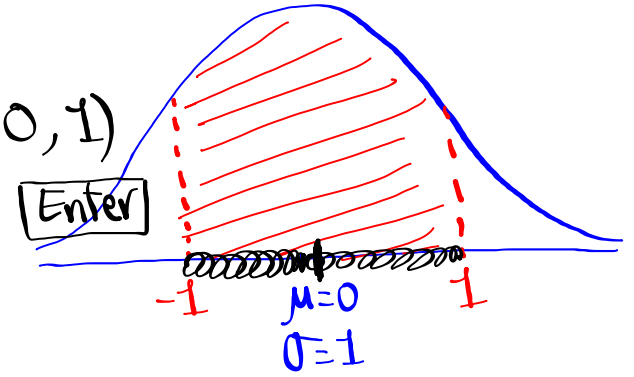
Upper: 1

$\mu = 0$

σ: 1

Paste Enter

Enter



$= .683 \approx 68\%$

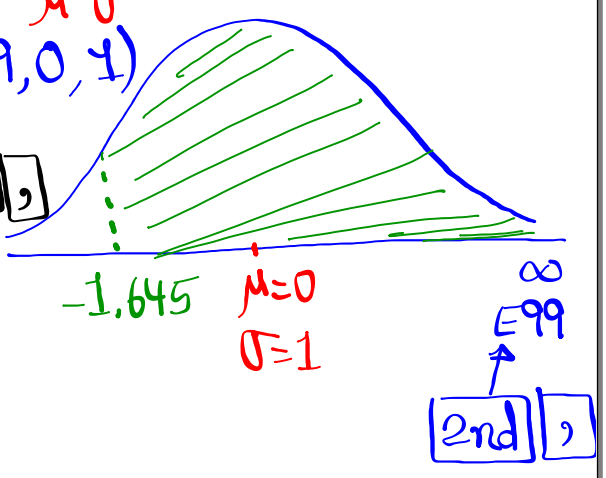
Find $P(Z > -1.645)$

$E99 = 10^{99}$

L U μ σ

=normalcdf(−1.645, E99, 0, 1)

(−) [1] [2nd] [,]



$= .950$

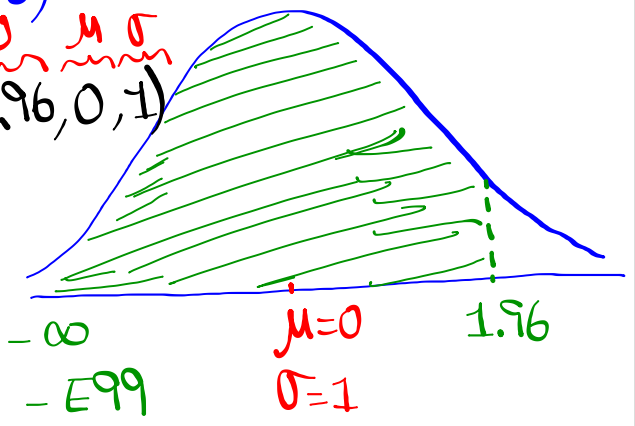
Find $P(Z < 1.96)$

L U μ σ

=normalcdf(−E99, 1.96, 0, 1)

(−)

2nd [,]

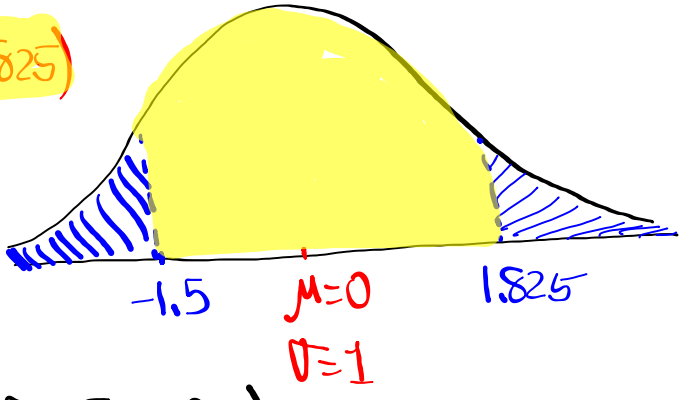


= .975 ✓

Find $P(Z < -1.5 \text{ OR } Z > 1.825)$

$= 1 - P(-1.5 < Z < 1.825)$

↑ Total Area



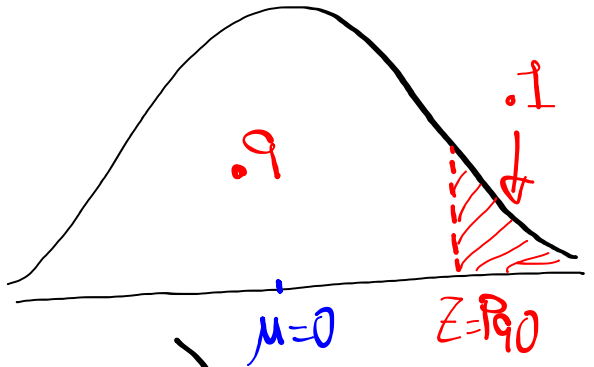
= 1 − normalcdf(−1.5, 1.825, 0, 1)

= .101

Find $z = P_{90}$

90% below

10% above



inverse process

$z = \text{invNorm}(\ .9\ ,\ 0\ ,\ 1\ )$ = **1.282**

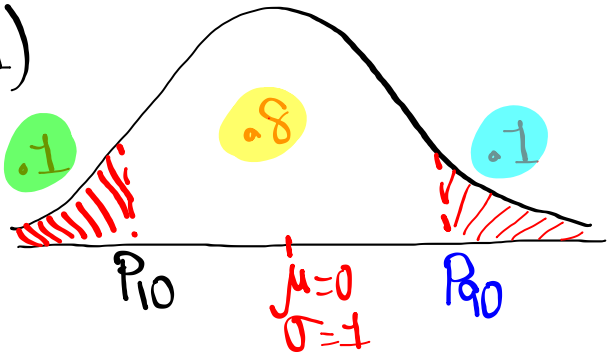
2nd VARS

Left Area μ σ

Find two z-values that separate the middle 80% from the rest.

$P_{10} = \text{invNorm}(.1, 0, 1)$

$= -1.282$



$P_{90} = \text{invNorm}(.9, 0, 1)$

$= 1.282$

Normal Prob. dist:

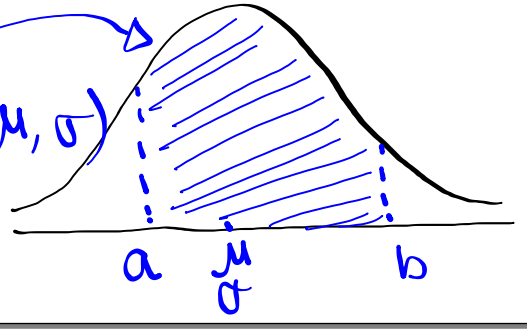
1) use x, $P(x=a)=0$

2) Graph is symmetric, Bell-Shape, Total area = 1.

3) Mean = Mode = Median

4) μ & σ are given in the problem.

5) $P(a<x<b)$



use normalcdf(L, U, μ, σ)

$N(\mu, \sigma)$

Given $N(84, 7)$

normal Prob. Dist.

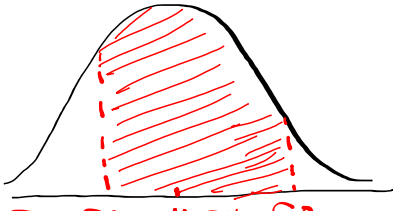
μ

σ

Find $P(80<x<90)$

L U μ σ

=normalcdf(80, 90, 84, 7)

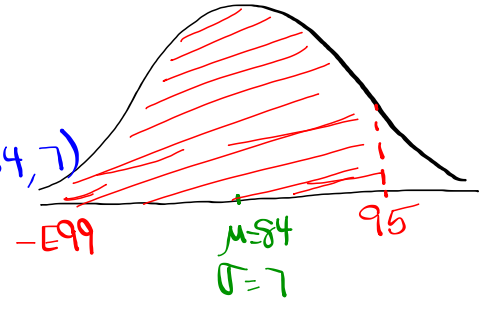


= .520

Find $P(x<95)$

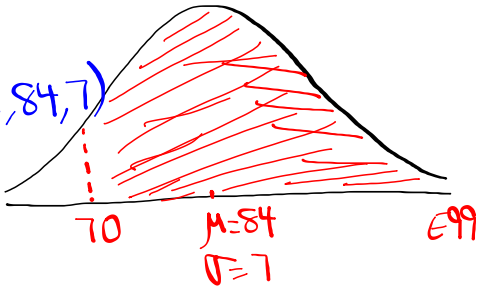
=normalcdf(-E99, 95, 84, 7)

= .942 ✓



Find $P(x>70)$

=normalcdf(70, E99, 84, 7)

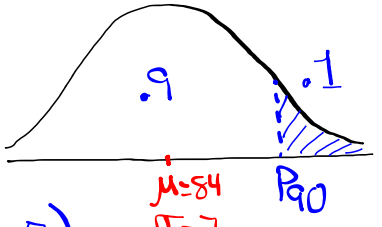


= .977

Find $x = P_{90}$, Round to a whole #

90% below

10% above



$x = P_{90}$ = invNorm(.9, 84, 7)

left Area, μ, σ

≈92.971

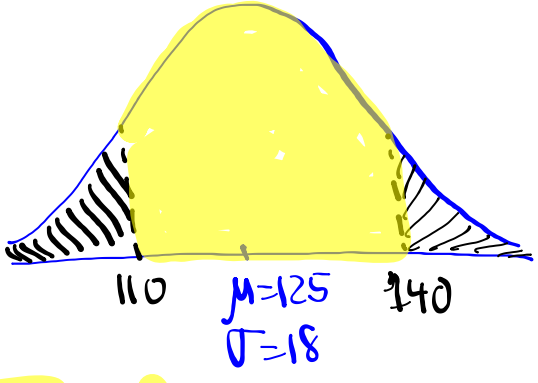
≈93

Consider a normal Prob. dist with the mean of 125 and standard deviation of 18. $N(125, 18)$

$P(x<110 \text{ OR } x>140)$

$= 1 - P(110<x<140)$

↑ Total Area = 1

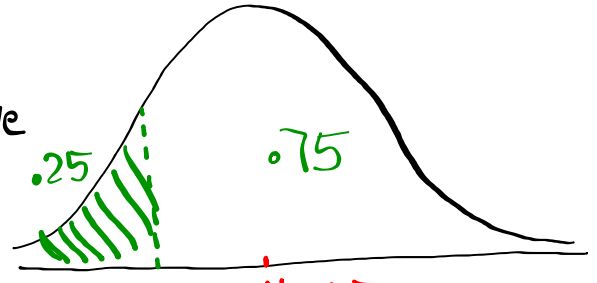


$= 1 - \text{normalcdf}(110, 140, 125, 18) = .405$

Find $x = Q_1$

25% Below

75% above



Left Area

μ σ

$x = Q_1 = \text{invNorm}(.25, 125, 18) = 112.859$

$\approx \boxed{113}$

Suppose Salaries of nurses are normally distributed with mean of \$6200/month and standard deviation of \$300/month.

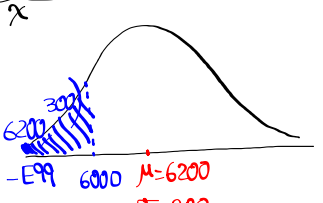
$N(6200, 300)$

If we randomly select one nurse, find the Prob. that his/her salary (x) is

a) below \$6000

$P(x < 6000)$

= normalcdf(-E99, 6000, 6200, 300)

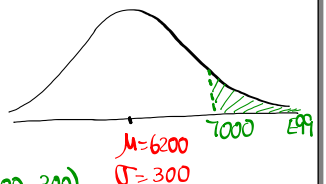


= .252

b) above \$7000

$P(x > 7000)$

= normalcdf(7000, E99, 6200, 300)



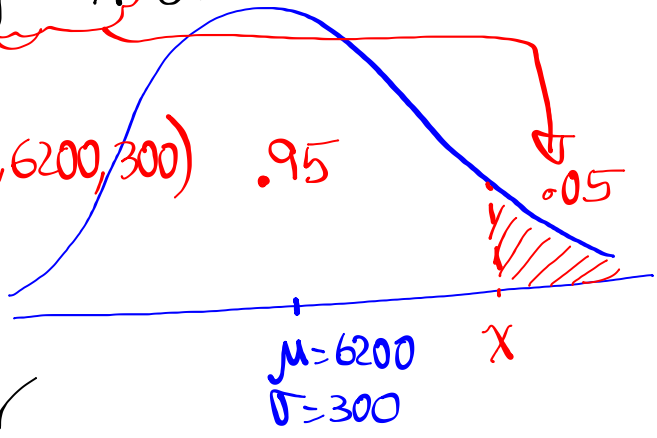
= .004

Find a salary, rounded to a whole #, that separates the top 5% from the rest.

$x = P_{95} = \text{invNorm}(.95, 6200, 300)$

$\approx \$6693$

SE 18 & 19



Clear all lists [2nd] [+] [4:] [Enter]

Reset all lists [STAT] Edit [5: Setup editor] [Enter]

Store 2, 6, 10, 14 in L1

L1
2
6
10
14

Use L1 with 1-Var Stats to find

$\mu = 8$ $\sigma = 4.472$ σ^2(exact) $= 20$

Let's take all samples of size 2 with replacement from this list.

2,2	2,6	2,10	2,14
6,2	6,6	6,10	6,14
10,2	10,6	10,10	10,14
14,2	14,6	14,10	14,14

Find $\bar{x}$ of each sample.

2	4	6	8
4	6	8	10
6	8	10	12
8	10	12	14

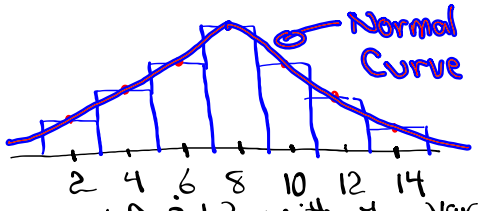
$\bar{x}$ of Samples

2	4	6	8
4	6	8	10
6	8	10	12
8	10	12	14

16 $\bar{x}$

$\bar{x}$	$P(\bar{x})$
2	1/16
4	2/16
6	3/16
8	4/16
10	3/16
12	2/16
14	1/16

Prob. dist. of $\bar{x}$



$\bar{x} \rightarrow$ L2

$P(\bar{x}) \rightarrow$ L3

L2	L3
2	1/16
4	2/16
6	⋮
⋮	⋮
14	1/16

Use L2 & L3 with 1-Var Stats

Find

$\mu = 8$ $\quad \sigma = 3.162$ $\quad \sigma^2(\text{exact}) = 10$

Clear all lists

Store 1, 3, 5, 7, and 9 in L1

Find

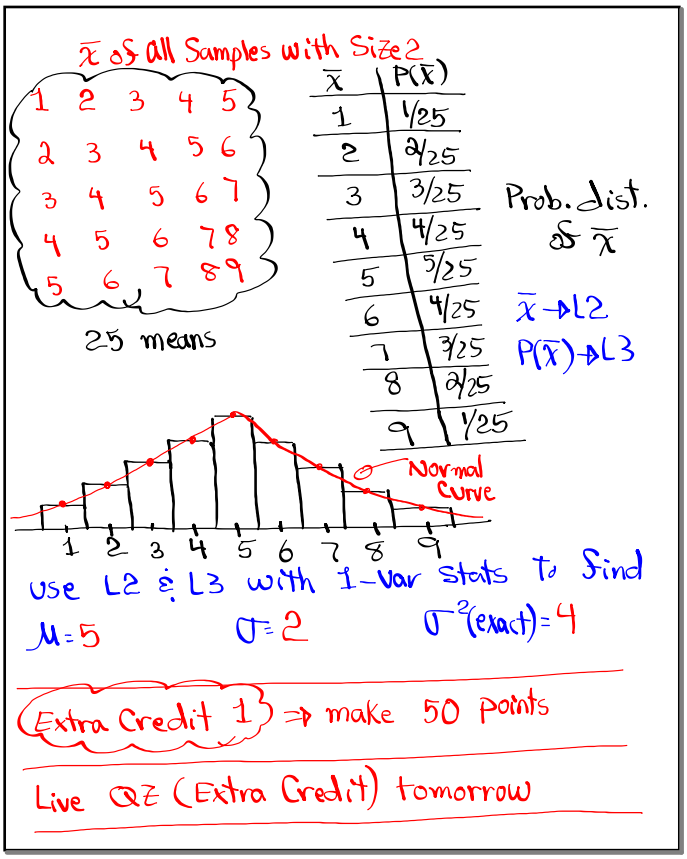
$\mu = 5$ $\quad \sigma = 2.828$ $\quad \sigma^2(\text{exact}) = 8$

Take all Samples of Size 2 with replacement.

1,1	1,3	1,5	1,7	1,9
3,1	3,3	3,5	3,7	3,9
5,1	5,3	5,5	5,7	5,9
7,1	7,3	7,5	7,7	7,9
9,1	9,3	9,5	9,7	9,9

Find $\bar{x}$ of each Sample

1	2	3	4	5
2	3	4	5	6
3	4	5	6	7
4	5	6	7	8
5	6	7	8	9


$\bar{x}$ of All Samples with Size 2
1 2 3 4 5
2 3 4 5 6
3 4 5 6 7
4 5 6 7 8
5 6 7 8 9
25 means
$\bar{x}$ | P($\bar{x}$)
1 | 1/25
2 | 2/25
3 | 3/25
4 | 4/25
5 | 5/25
6 | 4/25
7 | 3/25
8 | 2/25
9 | 1/25
Prob. dist. of $\bar{x}$
$\bar{x}$ → L2
P($\bar{x}$) → L3
Normal Curve
1 2 3 4 5 6 7 8 9
Use L2 & L3 with 1-Var Stats to Find
$\mu = 5$
$\sigma = 2$
σ^2(exact) = 4
Extra Credit 1 ⇒ make 50 points
Live QZ (Extra Credit) tomorrow