Statistics

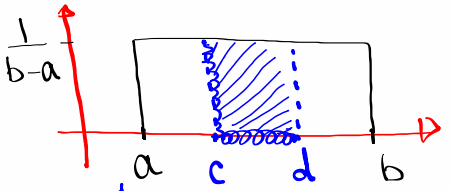
Lecture 9

Feb 19-8:47 AM

Working with Continuous random Variable (SG 18)

1) Uniform Prob. dist

Let x be a Cont. random variable with **Uniform Prob. dist.** for all values from a to b. → It has a rectangular graph



$$P(c < x < d) = (d-c) \cdot \frac{1}{b-a}$$

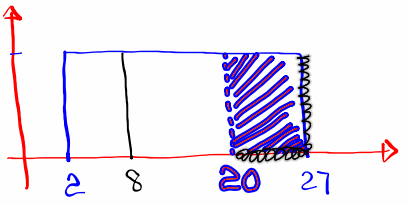
$$P(x = c) = 0$$

lines → Zero Area

Oct 24-6:51 PM

Let x be a Cont. random variable with Uniform Prob. dist. for all values from 2 to 27.

$\frac{1}{25} = \frac{1}{27-2}$



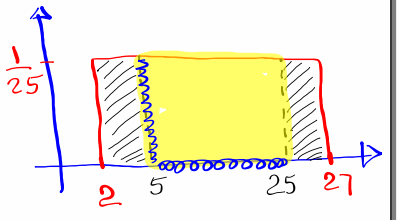
$P(x=8) = 0$

$P(x>20) = (27-20)\cdot\frac{1}{25} = \frac{7}{25} = .28$

$P(x<5 \text{ OR } x>25)$

$= 1 - P(5<x<25)$

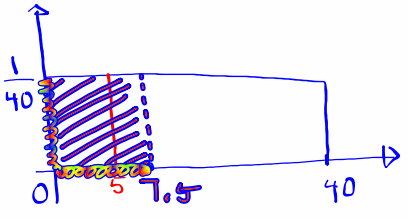
Total Prob.



$= 1 - (25-5)\cdot\frac{1}{25} = 1 - \frac{20}{25} = 1 - \frac{4}{5} = \frac{1}{5} = .2$

Oct 24-6:56 PM

Consider a uniform Prob. dist. for all values from 0 to 40.



$P(x=5) = 0$

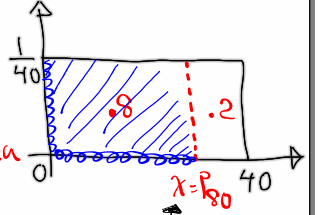
$P(x<7.5)$

$= (7.5-0)\cdot\frac{1}{40} = \frac{7.5}{40} = \frac{3}{16} \approx .188$

Find $x = P_{80}$

80% below — Left Area .8

20% above — Right Area .2



$(x-0)\cdot\frac{1}{40} = .8$

$x = 40(.8)$

$x = 32$

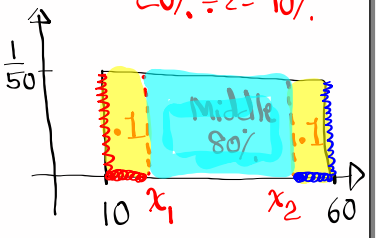
Oct 24-7:03 PM

Consider a uniform Prob. dist. for all values from 10 to 60.

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

$100\% - 80\% = 20\%$

$20\% \div 2 = 10\%$



$(x_1 - 10) \cdot \frac{1}{50} = .1$

$x_1 - 10 = 50(.1)$

$x_1 - 10 = 5$

$\boxed{x_1 = 15}$

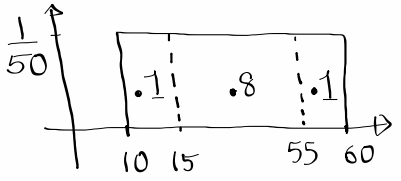
$(60 - x_2) \cdot \frac{1}{50} = .1$

$60 - x_2 = 50(.1)$

$60 - x_2 = 5$

$60 - 5 = x_2$

$\boxed{x_2 = 55}$



Oct 24-7:09 PM

Standard Normal Prob. Dist.:

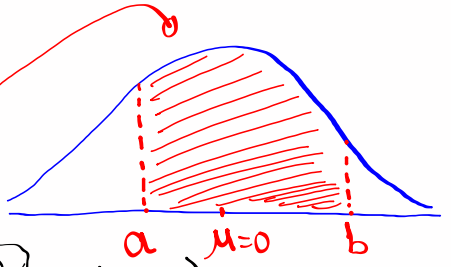
1) Use Z, $P(Z = c) = 0$

2) Dist. is Symmetric, bell-shape with total Area 1.

3) Mean = Mode = Median

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

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



How to find it:

2nd | VARS | normalcdf(L, U, μ, σ) $\sigma = 1$

Oct 24-7:16 PM

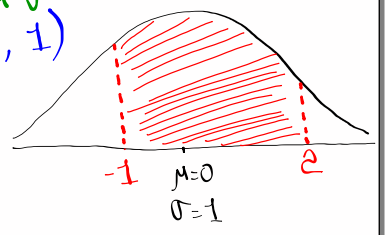
Find $P(-1 < Z < 2)$

L U μ σ

=normalcdf(−1, 2, 0, 1)

(−) [1]

= .819



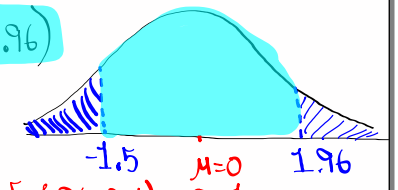
$P(Z < -1.5 \text{ OR } Z > 1.96)$

$= 1 - P(-1.5 < Z < 1.96)$

Total Area

=1−normalcdf(−1.5, 1.96, 0, 1)

= .092



Oct 24-7:21 PM

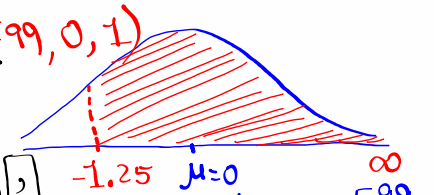
Find $P(Z > -1.25)$

=normalcdf(−1.25, E99, 0, 1)

(−) [1]

2nd [,]

= .894



2nd [,]

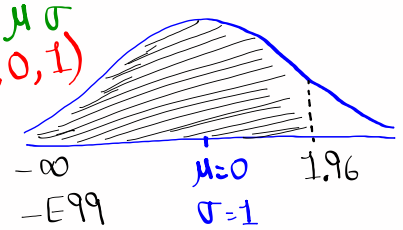
Find $P(Z < 1.96)$

L U μ σ

=normalcdf(−E99, 1.96, 0, 1)

(−) 2nd [,]

= .975

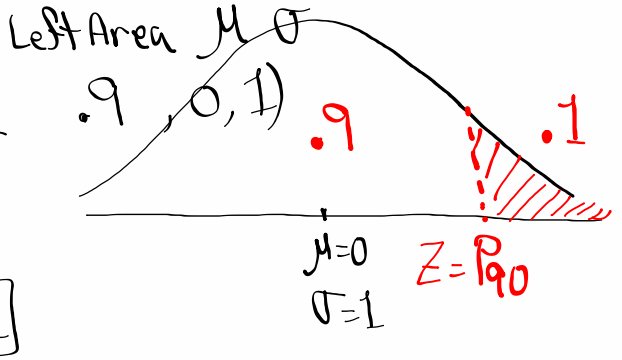


Oct 24-7:30 PM

Find $z = P_{90}$

90% below — Left Area .9

10% above — Right Area .1



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

2nd VARS

$= 1.282$

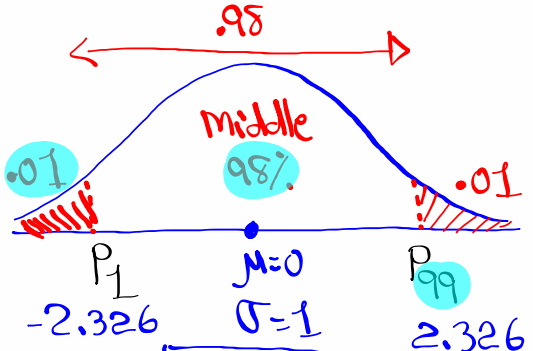
Oct 24-7:37 PM

Find Two z-values that separate the middle 98% from the rest.

Middle Area .98

$1 - .98 = .02$

$.02 \div 2 = .01$



$P_{99} = \text{invNorm}(.99, 0, 1) = 2.326$

$P_1 = \text{invNorm}(.01, 0, 1) = -2.326$

Oct 24-7:42 PM

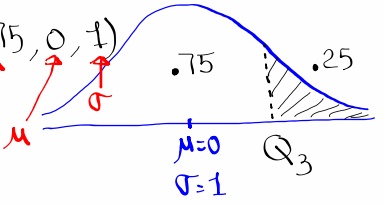
Find $Z = Q_3$

75% below 25% above

$Z = Q_3 = \text{invNorm}(.75, 0, 1)$

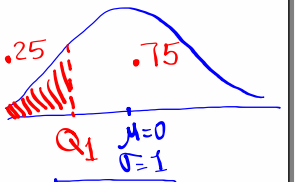
Left Area

$= \boxed{.674}$ ✓



Find $Z = Q_1$

25% below 75% above



$Z = Q_1 = \text{invNorm}(.25, 0, 1) = \boxed{-.674}$

SG 18 ✓

Oct 24-7:47 PM

SG 19

Normal Prob. dist:

1) Use x, $P(x=c)=0$

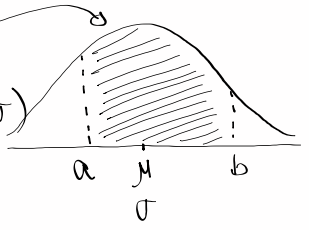
2) Dist. is Symmetric, Bell-Shape with total area 1.

3) Mean, mode, median are all Same.

4) μ & σ given in the Problem.

$P(a<x<b)$

$= \text{normalcdf}(L, U, \mu, \sigma)$



$N(\mu, \sigma)$

Normal Prob. Dist. Mean Standard Deviation

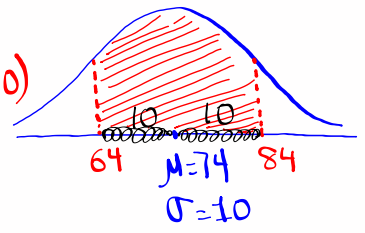
Oct 24-8:09 PM

Consider a normal Prob. dist. with $\mu = 74$ and $\sigma = 10$. $N(74, 10)$

Find $P(64 < x < 84)$

= normalcdf(64, 84, 74, 10)

= .683 $\approx 68\%$

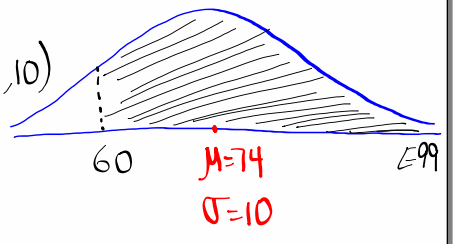


Find $P(x > 60)$

= normalcdf(60, E99, 74, 10)

2nd ,

= .919 $\approx 92\%$



Oct 24-8:14 PM

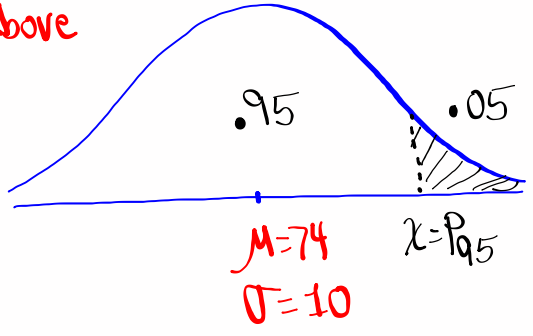
Find $x = P_{95}$

95% below

5% above

x = invNorm(.95, 74, 10)

= 90.449 $\approx$ 90



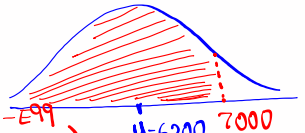
Oct 24-8:20 PM

Salaries of nurses are normally dist. with $\mu = \$6200$ and $\sigma = \$400$.

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

1) below $7000

$P(x < 7000)$



= normalcdf(-E99, 7000, 6200, 400)

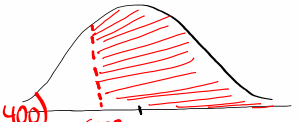
(-) 2nd 9

$\mu = 6200$
$\sigma = 400$

= .977 ≈ 98%

2) more than $6000

$P(x > 6000)$



= normalcdf(6000, E99, 6200, 400)

= .691

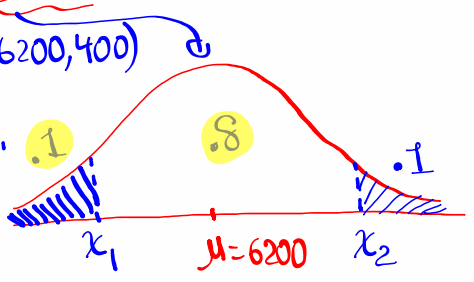
Oct 24-8:23 PM

Find two Salaries, Round to whole, that Separate the middle 80% from the rest.

$x_1 = P_{10}$ = invNorm(.1, 6200, 400)

= 5687.379...

≈ 5687



$x_2 = P_{90}$ = invNorm(.9, 6200, 400)

= 6712.621 ≈ 6713

SG 19

Oct 24-8:33 PM

Consider a binomial Prob. dist with $n=400$ & $P=.8$

$q = 1 - P = 1 - .8 = \boxed{.2}$

$\mu = np = 400(.8) = \boxed{320}$

$\sigma^2 = npq = 400(.8)(.2) = \boxed{64}$

$\sigma = \sqrt{\sigma^2} = \sqrt{64} = \boxed{8}$

68% Range $= \mu \pm \sigma = 320 \pm 8 \Rightarrow \boxed{312 \text{ to } 328}$

Usual Range $= \mu \pm 2\sigma = 320 \pm 2(8) \Rightarrow \boxed{304 \text{ to } 336}$
"95% Range"

Oct 24-8:40 PM

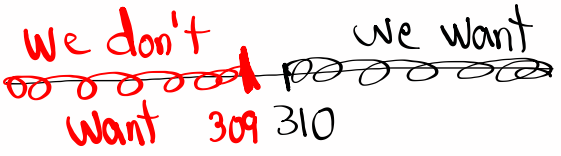
Let x be # of Successes,

$P(x \leq 325) = \text{binomcdf}(400, .8, 325)$

$= \boxed{.752}$

$P(x \geq 310) = 1 - P(x \leq 309)$

$= 1 - \text{binomcdf}(400, .8, 309)$



$= \boxed{.904}$

Oct 24-8:44 PM

You are making random guesses on a multiple choice exam with 80 questions. Each question has 4 choices but only one correct choice.

1) $n = 80$

2) $P = \frac{1}{4} = .25$

3) $q = \frac{3}{4} = .75$

4) $\mu = np$
$= \boxed{20}$

5) $\sigma^2 = npq$
$= \boxed{15}$

6) $\sigma = \sqrt{\sigma^2}$
$= \sqrt{15}$
$\approx \boxed{4}$

7) Find the prob. of guessing exactly 25 Correct ans.

$P(x = 25) = \text{binompdf}(80, .25, 25)$
$= \boxed{.043}$

8) Find the Prob. guesing between 15 and 25 Correct ans, inclusive.

$P(15 \le x \le 25) = \text{binomcdf}(80, .25, 25) -$
$\text{binomcdf}(80, .25, 14)$
$= \boxed{.846}$

Oct 24-8:48 PM

Consider a geometric prob. dist with $p = .2$

1) $q = 1 - p$
$= \boxed{.8}$

2) $\mu = \frac{1}{p}$
$= \frac{1}{.2} = \boxed{5}$

3) $\sigma^2 = \frac{q}{p^2}$
$= \frac{.8}{.2^2} = \boxed{20}$

4) $\sigma = \sqrt{\sigma^2}$
$= \sqrt{20} \approx \boxed{4.5}$

5) $P(x = 5) = \text{geometpdf}(.2, 5) = \boxed{.082}$

6) $P(x < 5) = P(x \le 4)$
$= \text{geometcdf}(.2, 4) = \boxed{.590}$

Oct 24-8:57 PM

Use poisson Prob. dist. with $\mu = 10$

1) Find $P(x = 12) =$ poissonpdf(10, 12)

$= .095$

2) $P(x \geq 8) = 1 - P(x \leq 7)$

$= 1 -$ Poissoncdf(10, 7)

We don't want 7 | We want 8

$= .780$ ✓

Oct 24-9:03 PM