Statistics

Fall 2022

Lecture 18

Feb 19-8:47 AM

Data
- 1) Qualitative
- 2) Quantitative
  - 1) Discrete (Countable)
  - 2) Continuous (Measureable)

Nov 22-6:03 AM

We are working with continuous random variable with prob. dist.:

1) Uniform Prob. dist.

2) Standard Normal Prob. dist.

3) Normal Prob. dist.

4) Applications

5) Central limit theorem

6) More Applications

SG 18 to SG 21

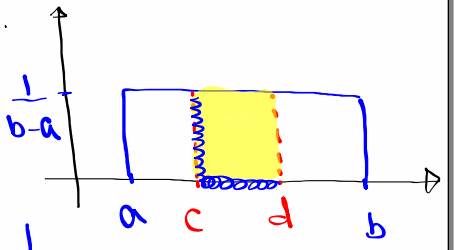
Nov 22-6:04 AM

Uniform Prob. dist:

Let x be a cont. random variable for $a \le x \le b$ with Uniform Prob. dist.

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

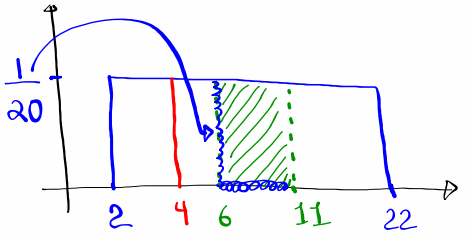
2) Graph of uniform Prob. dist. is rectangular with length from $x=a$ to $x=b$, and width of $\frac{1}{b-a}$.



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

Nov 22-6:07 AM

Consider a Uniform Prob. dist. for $2 \le x \le 22$



1) $P(x=4) = 0$

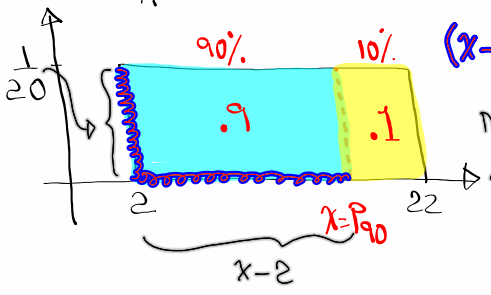
2) $P(6 < x < 11)$

$= (11-6) \cdot \frac{1}{20}$

$= \frac{5}{20} = \boxed{\frac{1}{4}} = \boxed{.25}$

3) Find $x = P_{90}$

90% below, 10% above



$(x-2) \cdot \frac{1}{20} = .9$

Multiply by 20

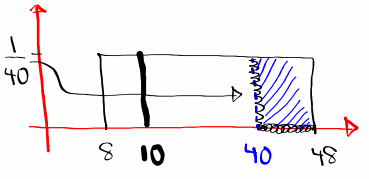
$x - 2 = 20(.9)$

$x = 2 + 18$

$\boxed{x = 20}$

Nov 22-6:12 AM

Consider a Uniform Prob. dist. for all values from 8 to 48

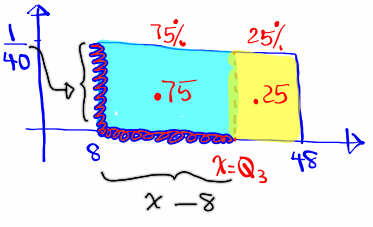


1) $P(x=10) = 0$

2) $P(x>40) = (48-40) \cdot \frac{1}{40} = \frac{8}{40} = \boxed{\frac{1}{5}} = \boxed{.2}$

3) Find $x = Q_3$

75% below, 25% above



Base · width = .75

$(x-8) \cdot \frac{1}{40} = .75$

Multiply by 40

$x - 8 = 40(.75)$

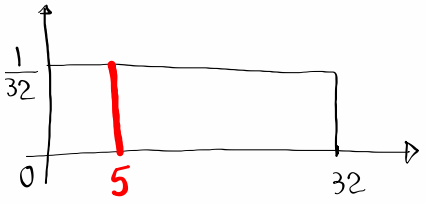
$x = 8 + 40(.75)$

$\boxed{x = 38}$

Nov 22-6:19 AM

Consider a Uniform Prob. dist. for all values from 0 to 32.

1) Draw & clearly label.



$P(x<4) = (4-0)\cdot\frac{1}{32} = \frac{4}{32}$

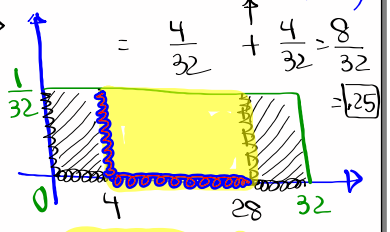
$P(x>28) = (32-28)\cdot\frac{1}{32} = \frac{4}{32}$

2) Find $P(x=5)$

$= 0$

3) $P(x<4 \text{ OR } x>28)$

$= \frac{4}{32} + \frac{4}{32} = \frac{8}{32}$



$= .25$

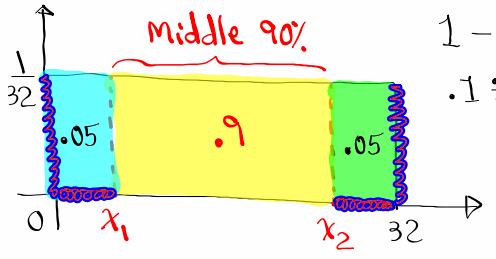
$= 1 - P(4<x<28)$

$= 1 - (28-4)\cdot\frac{1}{32}$

$= 1 - \frac{24}{32} = .25$

Nov 22-6:28 AM

4) Find two x-values that separate the middle 90% from the rest.



$1 - .9 = .1$

$.1 \div 2 = .05$

$(x_1 - 0)\cdot\frac{1}{32} = .05$

$x_1 - 0 = 32(.05)$

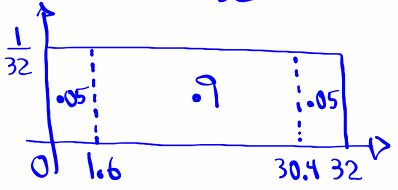
$x_1 = 1.6$

$(32 - x_2)\cdot\frac{1}{32} = .05$

$32 - x_2 = 32(.05)$

$32 - x_2 = 1.6$

$32 - 1.6 = x_2$



$x_2 = 30.4$

Nov 22-6:38 AM

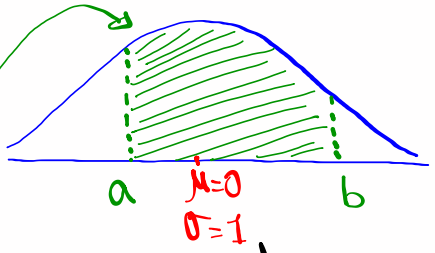
Standard Normal Prob. Dist.

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

2) Graph is bell-Shape, Symmetric, 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 graph.

How to find that area:

2nd VARS normalcdf(L, U, μ, σ)

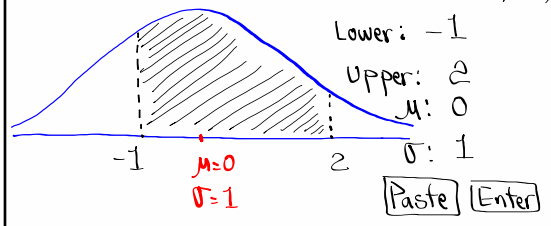
Nov 22-6:55 AM

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

L U μ σ

= normalcdf (-1, 2, 0, 1)

= .819

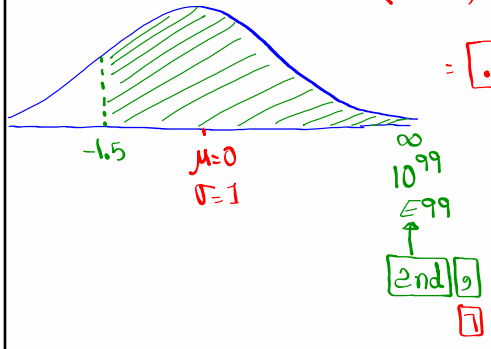


Find $P(Z>-1.5)$

L U μ σ

= normalcdf(-1.5, E99, 0, 1)

= .933

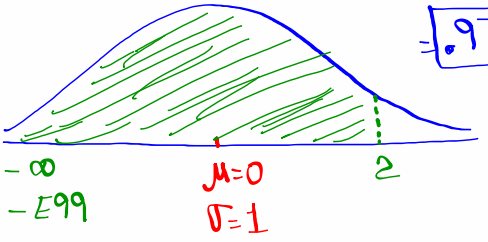


Nov 22-7:01 AM

Find $P(Z < 2)$

$= \text{normalcdf}(-E99, 2, 0, 1)$ (L, U, μ, σ)

$= .977$

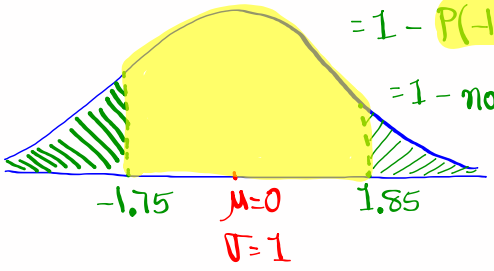


$P(Z < -1.75 \text{ OR } Z > 1.85)$

$= 1 - P(-1.75 < Z < 1.85)$

$= 1 - \text{normalcdf}(-1.75, 1.85, 0, 1)$ (L, U, μ, σ)

$= .072$

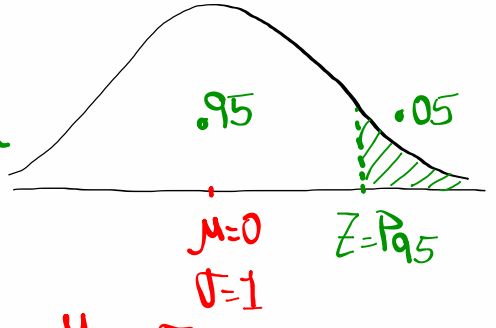


Nov 22-7:08 AM

Find $Z = P_{95}$, Round to 3-decimal places.

95% below — Left Area .95

5% above — Right Area .05



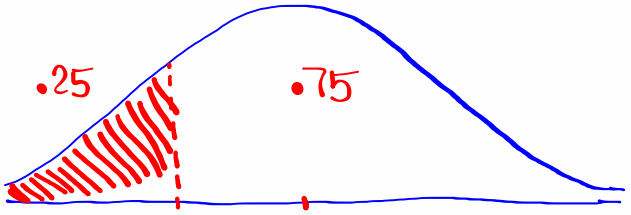
Now we use invNorm

(Left Area, μ, σ)

$Z = \text{invNorm}(.95, 0, 1) = 1.645$

Nov 22-7:15 AM

Find $Z = Q_1$, Round to 3-decimal places.



Q_1

0 → 25% below

→ 75% above

$Z = Q_1$ $\mu = 0$ $\sigma = 1$

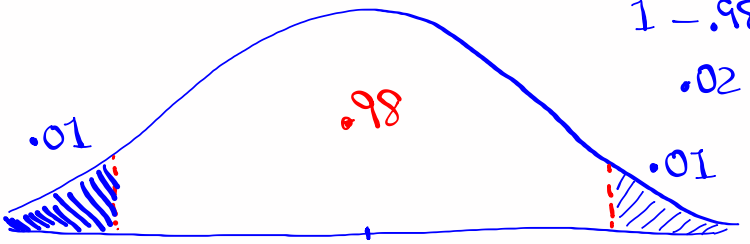
$Z = Q_1 = \text{invNorm}(\underset{\text{Left Area}}{.25}, \underset{\mu}{0}, \underset{\sigma}{1}) = \boxed{-.674}$

Nov 22-7:19 AM

Find two Z-values that separate the middle 98% from the rest.

$1 - .98 = .02$

$.02 \div 2 = .01$



$Z_1 = P_1$ $\mu = 0$ $\sigma = 1$ $Z_2 = P_{99}$

$Z_1 = P_1 = \text{invNorm}(.01, 0, 1) = \boxed{-2.326}$

$Z_2 = P_{99} = \text{invNorm}(.99, 0, 1) = \boxed{2.326}$

Nov 22-7:22 AM

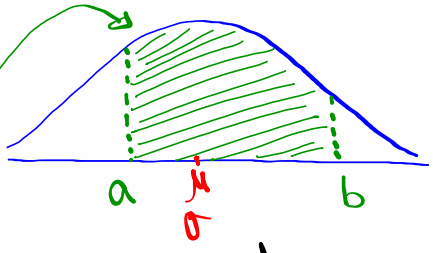
Normal Prob. Dist.

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

2) Graph is bell-shape, symmetric, with total Area = 1.

3) Mean = Mode = Median

4) μ & σ are given in the Problem



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

$N(\mu, \sigma)$

How to find that area:

2nd VARS normalcdf(L , U, μ, σ)

Nov 22-6:55 AM

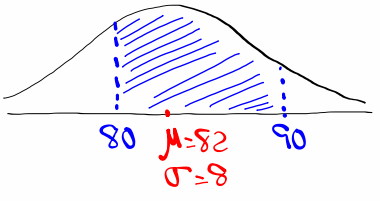
Given $N(82, 8)$

Normal Prob. Dist. $\mu = 82$ $\sigma = 8$

Find $P(80 < x < 90)$

= normalcdf(80, 90, 82, 8)

= .440

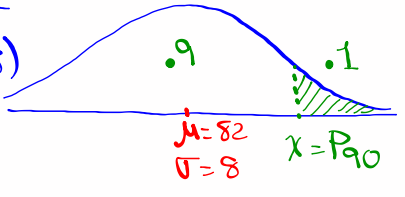


Find $x = P_{90}$, Round to a whole #.

Left Area μ σ

x = invNorm(.9, 82, 8)

= 92.252 ≈ 92



Nov 22-7:49 AM

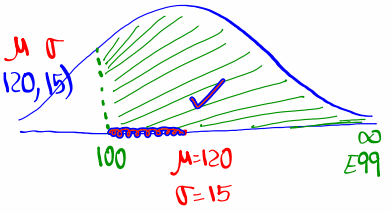
Consider a normal prob. dist with $\mu = 120$, and $\sigma = 15$.

Find $P(x > 100)$

= normalcdf(100, E99, 120, 15)

L U μ σ

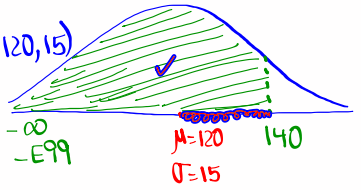
= .909



$P(x < 140)$

= normalcdf(−E99, 140, 120, 15)

= .909

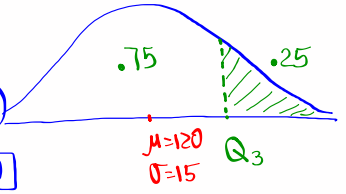


Find $x = Q_3$, Round to a whole #.

$x = Q_3$

= invNorm(.75, 120, 15)

= 130.117 ≈ 130



Nov 22-7:55 AM

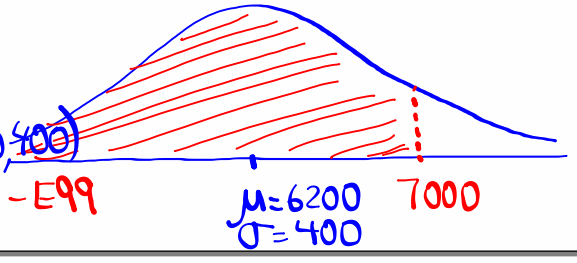
Salaries of nurses have a normal dist with mean of \$6200/mo. and standard deviation of \$400/mo. $N(6200, 400)$

If we randomly select one nurse, find the Prob. that his/her Salary (x) is below \$7000/mo. (< 7000)

$P(x < 7000)$

= normalcdf(−E99, 7000, 6200, 400)

= .977



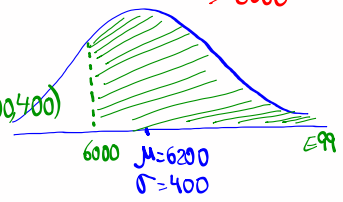
Nov 22-8:08 AM

If we randomly select one nurse find the Prob. that his/her Salary is more than $6000.
x >6000

$P(x>6000) =$

$=$ normalcdf(6000, E99, 6200, 400)

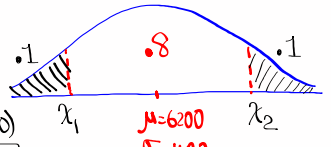
$= .691$



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

$1 - .8 = .2$

$.2 \div 2 = .1$



$x_1 = P_{10} =$ invNorm(.1, 6200, 400) ≈ 5687

$x_2 = P_{90}$

$=$ invNorm(.9, 6200, 400) ≈ 6713

SG 18 & SG 19

Exam II: Dec. 1, 2022

Nov 22-8:14 AM