Statistics

Lecture 12

Feb 19-8:47 AM

SG 18-19

Data
- 1) Qualitative
- 2) Quantitative
  - 1) Discrete "Countable" — SG 14-17
  - 2) Continuous "Measureable" — SG 18-21

Feb 1-4:34 PM

Working with Continuous random variable with Prob. dist

1) Uniform Prob. dist
2) Standard normal Prob. dist.
3) Normal Prob. dist.
4) Central limit theorem
5) Applications

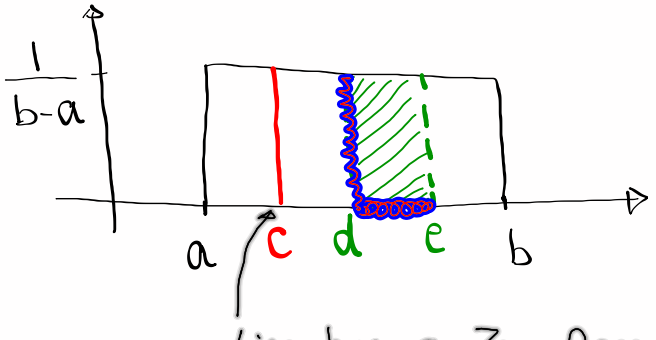
SG 18-21

Feb 1-4:37 PM

Uniform Prob. dist.:

Let x be a Continuous random variable

for all values from a to b with a uniform Prob. dist.



Line has a Zero Area.

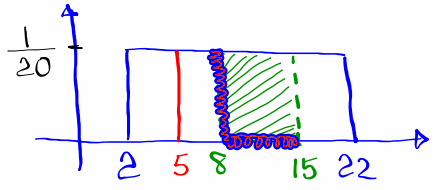
$P(x=c)=0$

$P(d<x<e)=$

$(e-d)\cdot\frac{1}{b-a}$

Feb 1-4:39 PM

Let x be a cont. random variable for all values from 2 to 22 with a uniform Prob. dist.



1) $P(x=5)=0$

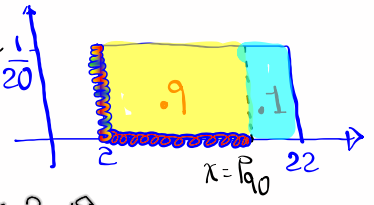
2) $P(8<x<15)$

$=(15-8)\cdot\frac{1}{20}$

$=\frac{7}{20}=.35$

3) Find $x=P_{90}$

90% below, 10% above



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

$x-2=20(.9)$

$x-2=18$

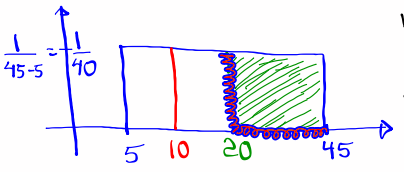
$x=20$

$P_{90}=20$

Feb 1-4:44 PM

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

↳ Rectangular graph



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

2) $P(x>20)$

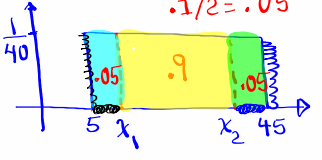
$(45-20)\cdot\frac{1}{40}$

$=\frac{25}{40}=\frac{5}{8}=.625$

3) Find two values that separate the middle 90% from the rest.

$1-.9=.1$

$.1/2=.05$



$(x_1-5)\cdot\frac{1}{40}=.05$

$x_1-5=40(.05)$

$x_1-5=2$

$x_1=7$

$(45-x_2)\cdot\frac{1}{40}=.05$

$45-x_2=40(.05)$

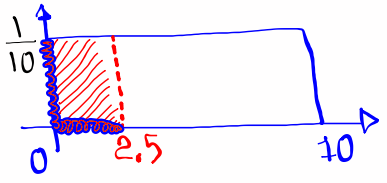
$45-x_2=2$

$45-2=x_2$

$x_2=43$

Feb 1-4:51 PM

Habit Burger says wait time to be served has a uniform Prob. dist and it takes no more than 10 minutes.



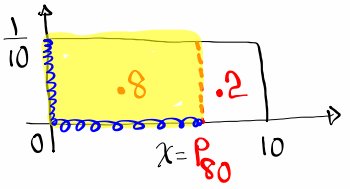
Find the prob. for a randomly selected customer's wait time is below 2.5 minutes

$P(x<2.5)=$

$(2.5-0)\cdot\frac{1}{10}=\frac{2.5}{10}$

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

Find the P_{80} of the wait-time



$(x-0)\cdot\frac{1}{10}=.8$ $\quad x\cdot\frac{1}{10}=.8$ $\quad x=10(.8)$

$\boxed{x=8}$

SG 18 (Page 1-2)

Feb 1-5:01 PM

Standard Normal Prob. dist.:

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

2) Data dist. is Symmetric, bell-shape with total area 1.

3) Mean = Mode = Median

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

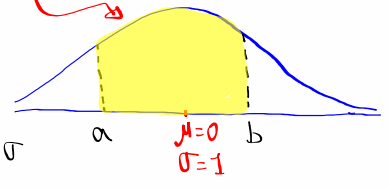
5) $P(a<Z<b)$ is the area of the Corresponding region within the bell-shape.

How to find it:

2nd VARS

normalcdf

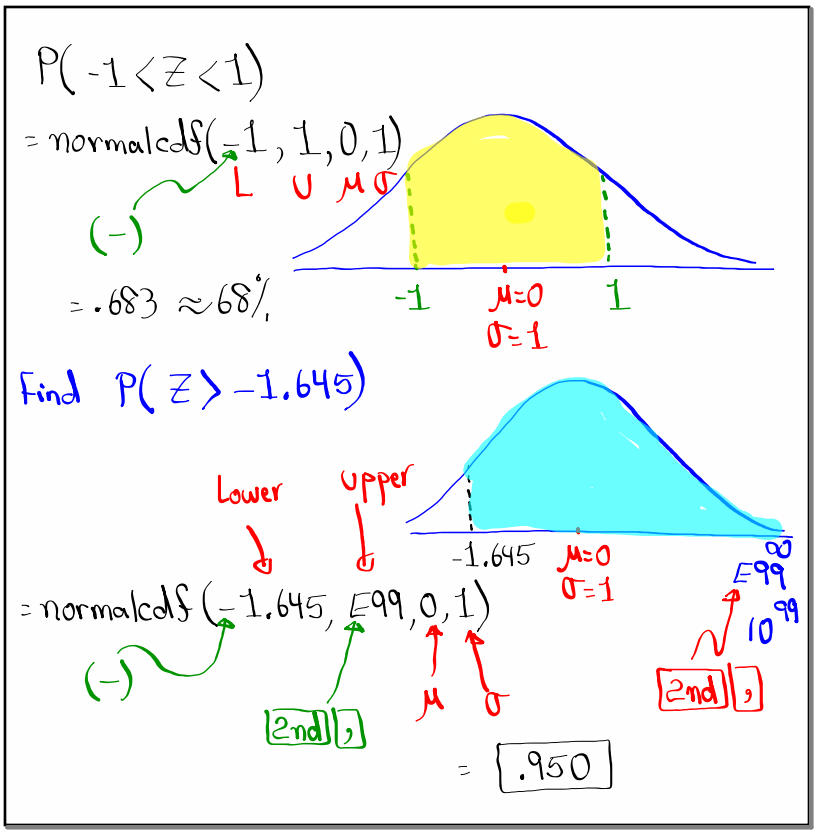
Lower, upper, μ, σ



NO Exception

Full Drawing, labeling, shading, TI command Required

Feb 1-5:10 PM



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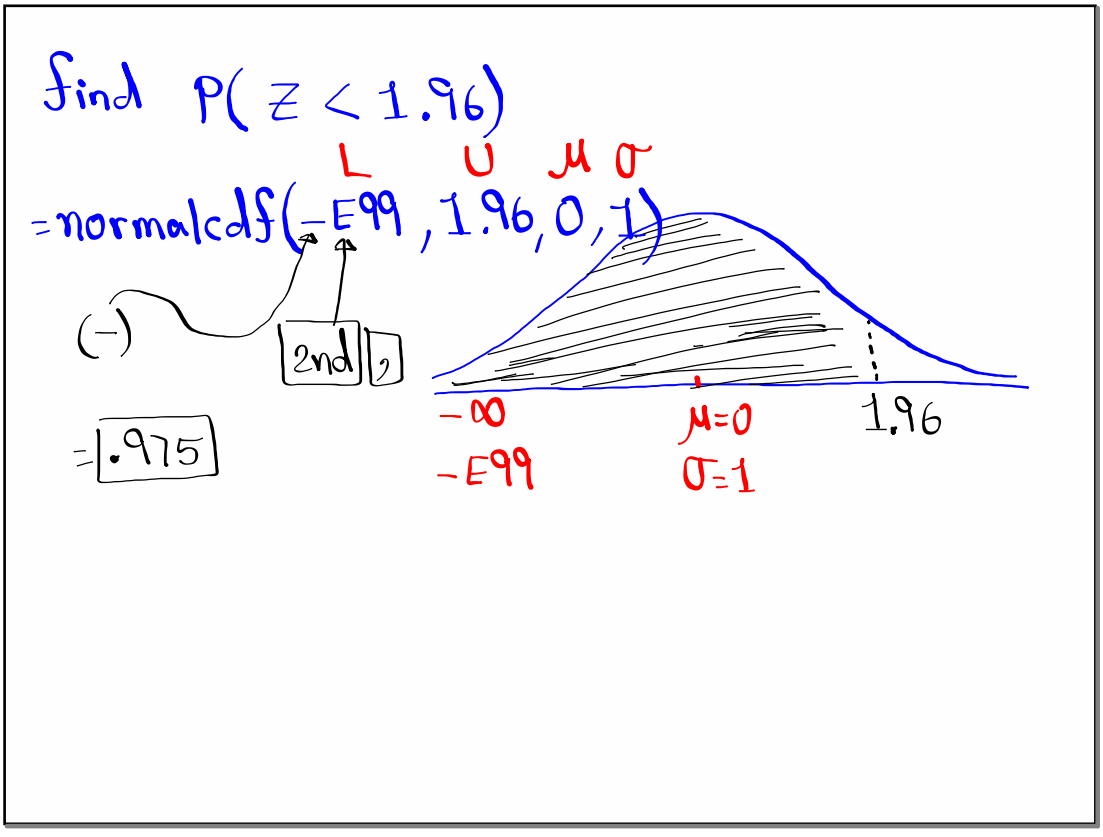


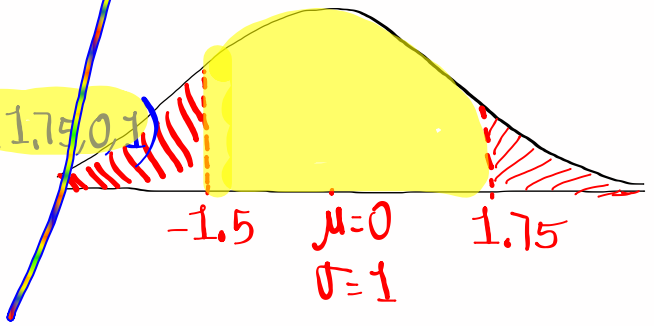
Feb 1-5:25 PM

Find $P(Z < -1.5 \text{ OR } Z > 1.75)$

Total Area = 1

$= 1 - \text{normalcdf}(-1.5, 1.75, 0, 1)$

$= \boxed{.107}$



If OR was and

No Overlap → 0

Feb 1-5:27 PM

Find $Z = Q_3$

Third Quartile

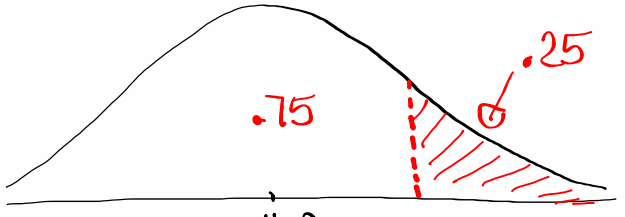
75% below, 25% above

Reverse Process

2nd

VARS

invNorm(Left Area , μ, σ)



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

$= \boxed{.674}$

Feb 1-5:33 PM

Find $z = P_{90}$

90% below

10% above

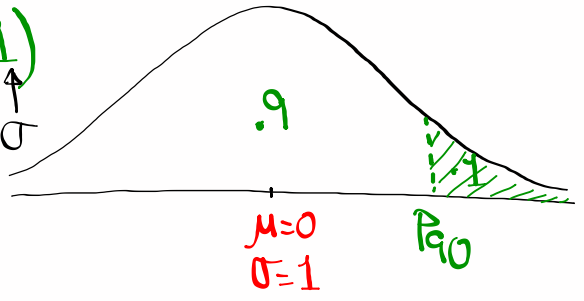
$z = \text{invNorm}(.9, 0, 1)$

Left Area

μ

σ

$= \boxed{1.282}$

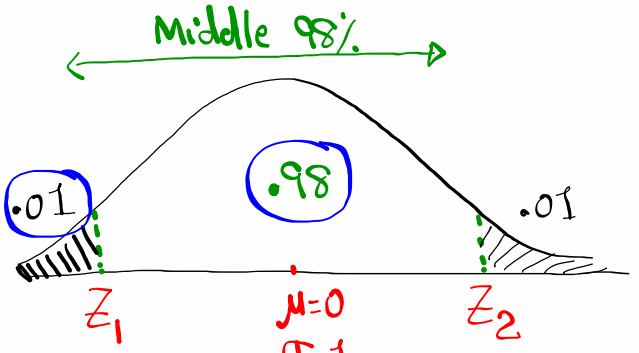


Feb 1-5:37 PM

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

$1 - .98 = .02$

$.02/2 = .01$



$z_1 = \text{invNorm}(.01, 0, 1) = \boxed{-2.326}$

$z_2 = \text{invNorm}(.99, 0, 1) = \boxed{2.326}$

Feb 1-5:58 PM

Normal Prob. Dist.:

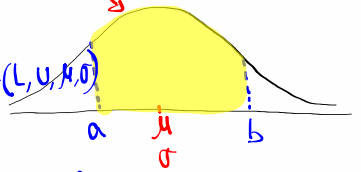
1) use x , $P(x=c) = 0$

2) Data dist is symmetric, bell-shape 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.



Once again, we use normalcdf(L, U, μ, σ)

Drawing, labeling, shading, full TI command required.

$N(\mu, \sigma)$

Feb 1-6:02 PM

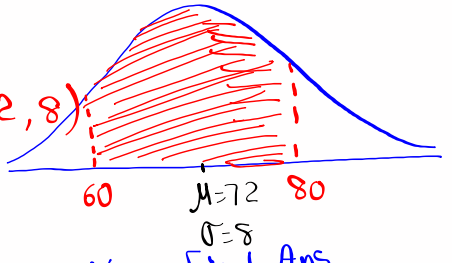
Given $N(72, 8)$

Normal, $\mu = 72$, $\sigma = 8$

$P(60 < x < 80)$

= normalcdf(60, 80, 72, 8)

= .775

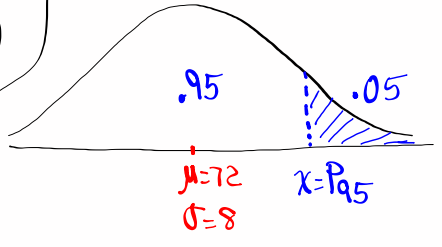


Find $x = P_{95}$, Round-up Your Final Ans.

x = invNorm(.95, 72, 8)

= 85.1...

≈ 86



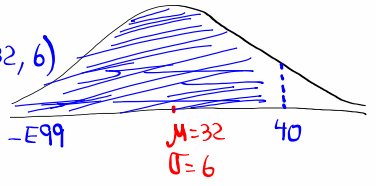
Feb 1-6:08 PM

Consider a normal Prob. dist with $\mu = 32$ and $\sigma = 6$. $N(32, 6)$

1) $P(x < 40)$

= normalcdf(-E99, 40, 32, 6)

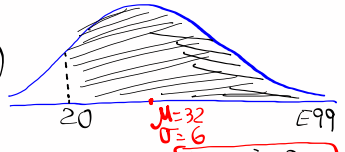
= .909



2) $P(x > 20)$

= normalcdf(20, E99, 32, 6)

= .977 ≈ 97.7%

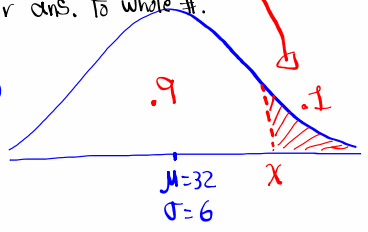


3) Find x-value that separates the top 10% from the rest. Round your ans. to whole #.

x = invNorm(.9, 32, 6)

= 39.689

≈ 40



Feb 1-6:14 PM

Salaries of nurses has a normal dist with mean of \$6500/mo. and standard deviation of \$400/mo. $N(6500, 400)$

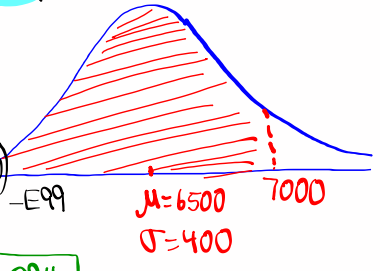
If we randomly select one nurse, find the Prob. that his/her salary is

a) below \$7000/mo.

$P(x < 7000)$

= normalcdf(-E99, 7000, 6500, 400)

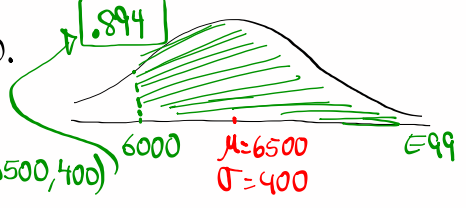
= .894



b) more than \$6000.

$P(x > 6000)$

= normalcdf(6000, E99, 6500, 400)



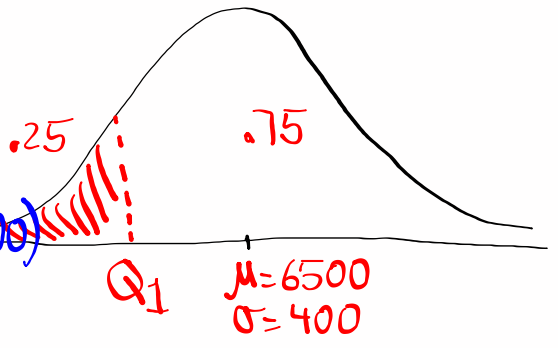
Feb 1-6:22 PM

Find Q_1 for the Salaries of nurses.

First Quartile

25% below,

75% above



$Q_1 = \text{invNorm}(.25, 6500, 400)$

$= 6230.204$

$\not\$ 6230$

$\$6230$

Feb 1-6:32 PM

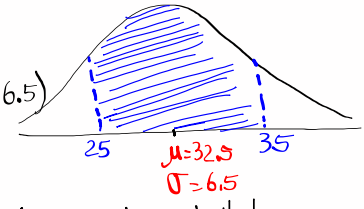
Ages of students are normally dist. with $\mu = 32.5$ Yrs and $\sigma = 6.5$ Yrs. $N(32.5, 6.5)$

If we randomly select one student, find the prob. that his/her age (x) falls between 25 & 35 Yrs.

$P(25 < x < 35)$

$= \text{normalcdf}(25, 35, 32.5, 6.5)$

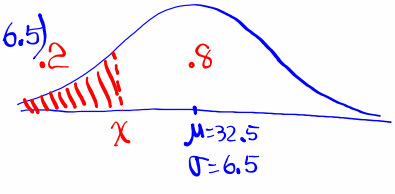
$= .525$



Find the age, rounded to 1-decimal, that separates the bottom 20% from the rest.

$x = \text{invNorm}(.2, 32.5, 6.5)$

≈ 27.0

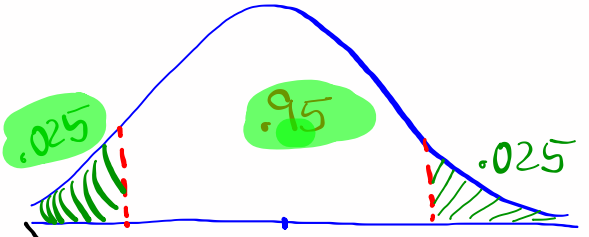


Feb 1-6:36 PM

Find two ages, rounded to 1-decimal, that separate the middle 95% from the rest.

$1 - .95 = .05$

$.05/2 = .025$



$x_1 = \text{invNorm}(.025, 32.5, 6.5)$

$= \boxed{19.8}$

$x_2 = \text{invNorm}(.975, 32.5, 6.5) \approx \boxed{45.2}$

Feb 1-6:45 PM

You are making random guesses on a multiple-choice exam with 90 questions.

Each question has 6 choices but one correct choice.

Success is to guess correct answer.

$n = 90 \quad p = \frac{1}{6} \quad q = \frac{5}{6}$

$\mu = np = 90\left(\frac{1}{6}\right) = \boxed{15} \quad \sigma^2 = npq = 90\left(\frac{1}{6}\right)\left(\frac{5}{6}\right) = \boxed{12.5}$

$\sigma = \sqrt{\sigma^2} = \sqrt{12.5} \approx 3.536 \approx \boxed{3.5}$

Usual Range "95% Range" $\mu \pm 2\sigma = 15 \pm 2(3.5)$

$= 15 \pm 7 \rightarrow \boxed{8 \text{ to } 22}$

Find the prob. of guessing at most one-fifth of them correctly. $\frac{1}{5} \cdot 90 = 18$

$P(x \le 18) = \text{binomcdf}(90, 1/6, 18) = \boxed{.839}$

Find the prob. of guessing at least one-tenth of them correctly. $\frac{1}{10} \cdot 90 = 9$

$P(x \ge 9) = 1 - P(x \le 8)$

8 9

$= 1 - \text{binomcdf}(90, 1/6, 8)$

$= \boxed{.974}$

Find the Prob. of guessing from 8 to 22 Correct ans.

$P(8 \le x \le 22) = P(x \le 22) - P(x \le 7)$

$P = \boxed{.967}$

7 8 22

$= \text{binomcdf}(90, 1/6, 22) - \text{binomcdf}(90, 1/6, 7)$

Feb 1-6:50 PM