Statistics

Fall 2022

Lecture 20

Data

1) Qualitative

2) Quantitative

1) Discrete

2) Continuous

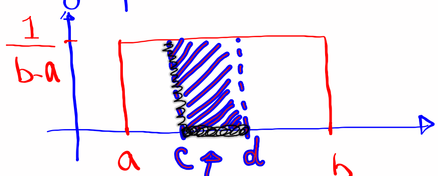
Let x be a continuous random variable with prob. dist. $P(x)$

Uniform Prob. dist.

1) x is a random variable for all values from a to b. $\boxed{a \le x \le b}$

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

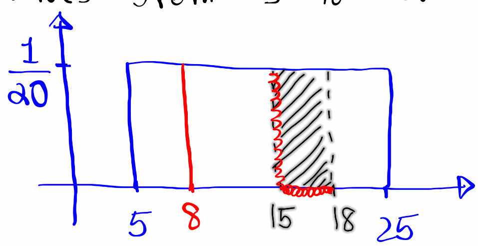
3) Uniform Prob. dist. has a rectangular graph as shown below.



4) $\boxed{P(c<x<d)}$ is the corresponding shaded area above.

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

Consider a uniform Prob. dist. for all values from 5 to 25.

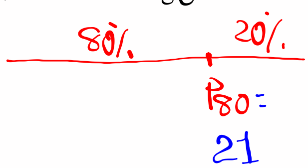


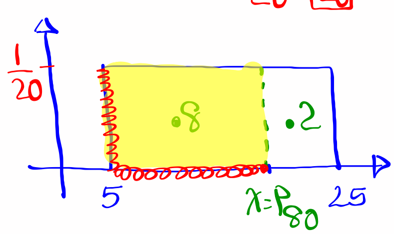
1) find $P(x=8)=0$

2) find $P(15<x<18)$

$=(18-15)\cdot\frac{1}{20}=\boxed{\frac{3}{20}}=\boxed{.15}$

3) find $x=P_{80}$



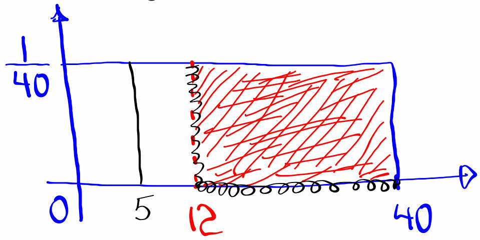


$(x-5)\cdot\frac{1}{20}=.8$

$x-5=20(.8)$

$x-5=16 \rightarrow \boxed{x=21}$

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



1) Find $P(x=5)=\boxed{0}$

2) Find $P(x>12)$

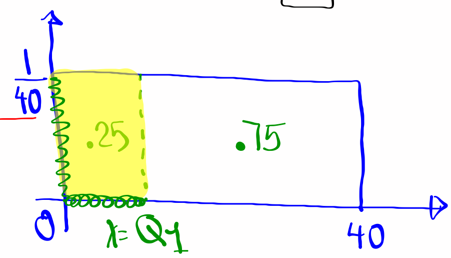
$=(40-12)\cdot\frac{1}{40}$

$=\frac{28}{40}=\boxed{\frac{7}{10}}=\boxed{.7}$

3) Find $x=Q_1$

25% 75%

Q_1



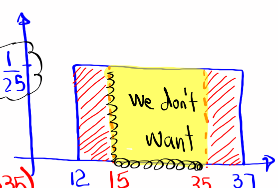
$(x-0)\cdot\frac{1}{40}=.25$

$x=40(.25)$

$\boxed{x=10}$

Consider a uniform Prob. dist for all Values from 12 to 37.

1) Draw & label clearly $\frac{1}{25}$



2) Find $P(x<15 \text{ OR } x>35)$

$=\underset{\text{Total Area}}{1}-\underset{\text{we don't want}}{P(15<x<35)}=1-(35-15)\cdot\frac{1}{25}$

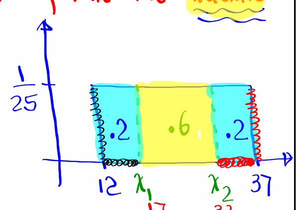
$=1-\frac{20}{25}=1-\frac{4}{5}=\boxed{\frac{1}{5}}$

3) Find two values that separate the middle 60% from the rest.

$1-.6=.4$

Total Area

$.4\div 2=.2$



$(x_1-12)\cdot\frac{1}{25}=.2$

$x_1-12=25(.2)$

$x_1-12=5$

$\boxed{x_1=17}$

$(37-x_2)\cdot\frac{1}{25}=.2$

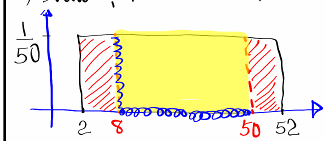
$37-x_2=25(.2)$

$37-x_2=5$

$37-5=x_2 \Rightarrow \boxed{x_2=32}$

Consider a Uniform prob. dist. for all Values from 2 to 52.

1) Draw & label clearly.



2) Find $P(x<8 \text{ OR } x>50)$

$= 1 - P(8 < x < 50)$

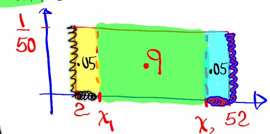
$= 1 - (50-8)\cdot\frac{1}{50}$

$= 1 - \frac{42}{50} = \boxed{\frac{4}{25}}$

3) Find two x-Values that Separate the middle 90% from the rest.

$1 - .9 = .1$

$.1 \div 2 = .05$



$(x_1 - 2)\cdot\frac{1}{50} = .05$

$x_1 - 2 = 50(.05)$

$x_1 = 2 + 2.5$

$\boxed{x_1 = 4.5}$

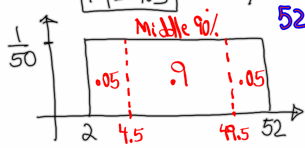
$(52 - x_2)\cdot\frac{1}{50} = .05$

$52 - x_2 = 50(.05)$

$52 - x_2 = 2.5$

$52 - 2.5 = x_2$

$\boxed{49.5 = x_2}$



SG 18

Page 1 & Top of Page 2.

Standard Normal Prob. Dist.: SG 18

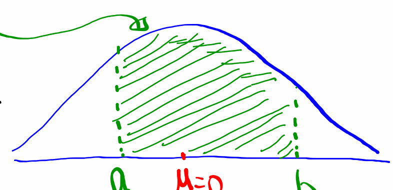
1) use Z, $P(Z=c) = 0$

2) Prob. dist. is symmetric, bell-Shape with total area $= 1$.

3) Mean = Mode = Median

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

5) $\boxed{P(a < Z < b)}$ is the Corresponding area within the graph as shown below.



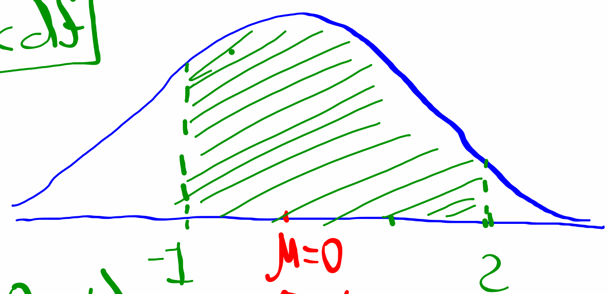
How to find that area:

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$

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

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

$\boxed{\text{2nd}}$ $\boxed{\text{VARS}}$ $\boxed{\text{normalcdf}}$



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

(−)

$= \boxed{.819}$

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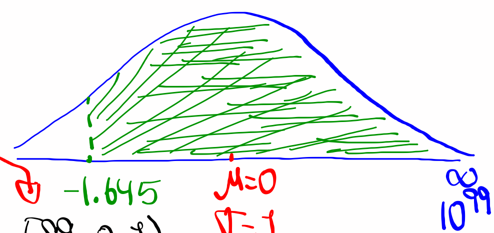
find $P(Z > -1.645)$

$\boxed{\text{2nd}}\boxed{,}$

(−)



= normalcdf$(-1.645, E99, 0, 1)$

$= \boxed{.950}$

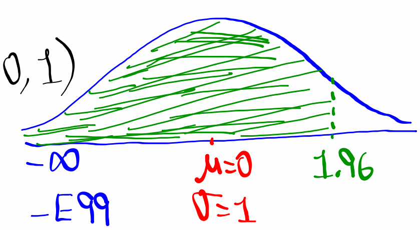
$\boxed{\text{2nd}}\boxed{,}$

$P(Z < 1.96)$

= normalcdf$(-E99, 1.96, 0, 1)$

(−)

$\boxed{\text{2nd}}\boxed{,}$



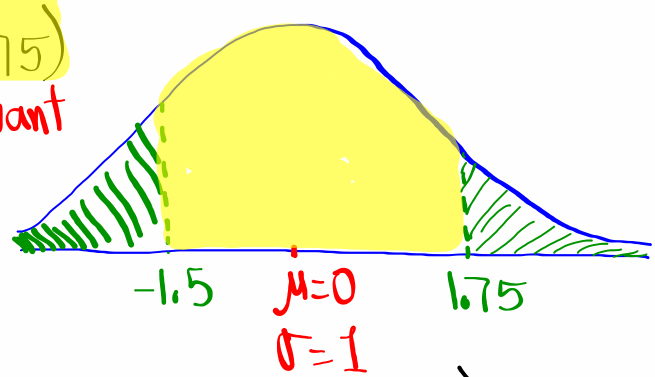
$= \boxed{.975}$

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

$= 1 - P(-1.5 < Z < 1.75)$

Total Area

we don't want



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

L U μ σ

(−)

$= \boxed{.107}$

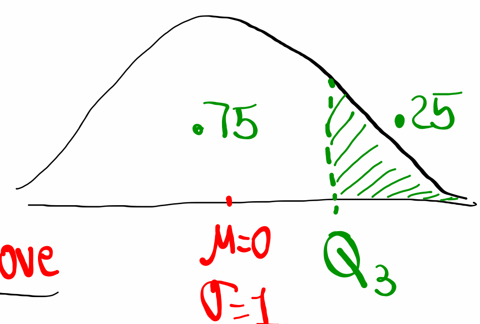
Doing Reverse:

find $Z = Q_3$

75% below | 25% above

$\underbrace{75\% \text{ below}}_{\text{Left Area}}$ $\underbrace{25\% \text{ above}}_{\text{Right Area}}$

Left Area .75   Right Area .25



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

Left Area μ σ

$\boxed{2nd}$ $\boxed{VARS}$ $\boxed{invNorm}$ $= \boxed{.674}$

Find $z = P_{98}$

98% below — Left Area — $.98$

2% above — Right Area — $.02$

$z = P_{98}$

$= \text{invNorm}(.98, 0, 1)$

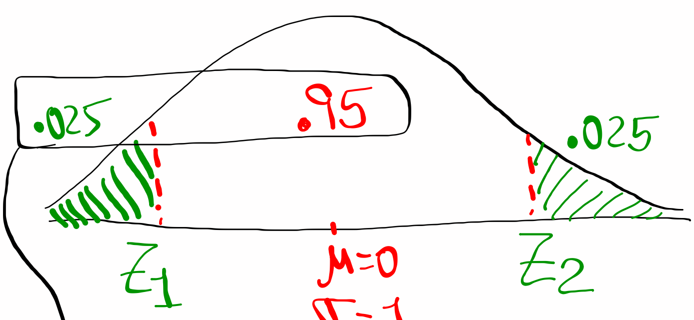
left Area: $.98$; μ: 0; σ: 1

$= \boxed{2.054}$

Find two z-values that separate the middle 95% from the rest.

$1 - .95 = .05$

$.05 \div 2 = .025$

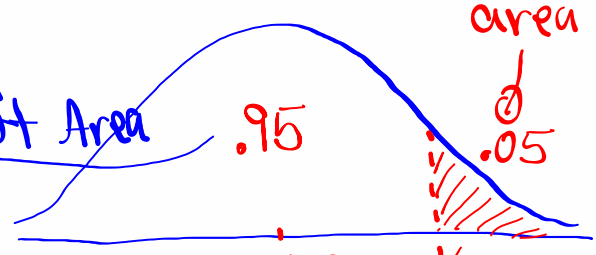


$z_1 = \text{invNorm}(.025, 0, 1) = \boxed{-1.960}$

$z_2 = \text{invNorm}(.975, 0, 1) = \boxed{1.960}$

Find K such that $P(Z > K) = .05$

Right area



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

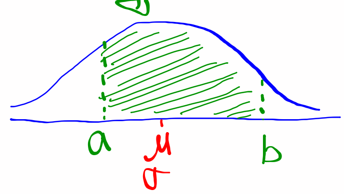
$= \boxed{1.645}$

SG 18
Page 2, and
Part of Pag 3.

Normal Prob. dist. (SG 18)

1) Use x, $P(x=c)=0$
2) Graph is symmetric, bell-shape with total area $=1$
3) Mean = Mode = Median
4) μ & σ are given in the problem.
5) $\boxed{P(a < x < b)}$ is the corresponding area within the bell-shape graph as shown below.

Use
normalcdf(L, U, μ, σ)



$N(\mu, \sigma)$

Normal Mean Standard deviation

Consider a normal Prob. dist. with $\mu=82$ & $\sigma=10$

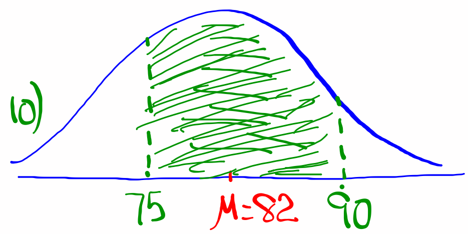
$\underbrace{\text{normal Prob. dist. with } \mu=82 \ \& \ \sigma=10}_{N(82,10)}$

find

$P(75 < x < 90)$

$=\text{normalcdf}(75, 90, 82, 10)$

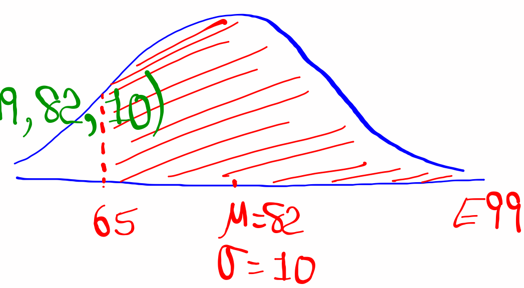
$= \boxed{.546}$ ✓



$P(x > 65)$

$=\text{normalcdf}(65, E99, 82, 10)$

$= \boxed{.955}$



Find x-value that Separates the top 10%

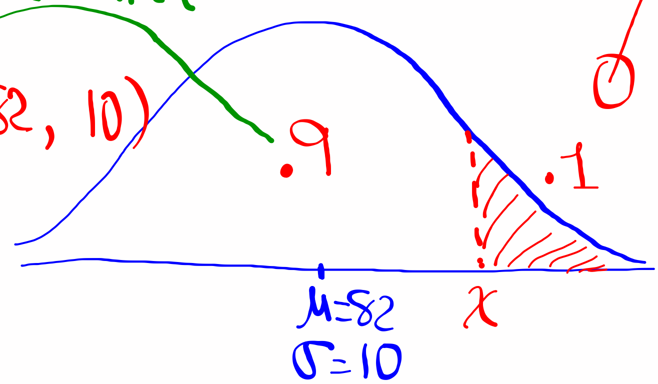
from the rest. Round to a whole number.

Left Area

$x = \text{invNorm}(.9, 82, 10)$

$= 94.816$

≈ 95



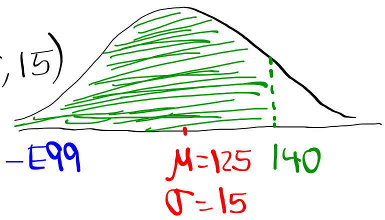
Given $N(125, 15)$

Normal μ σ

Find $P(x < 140)$

$= \text{normalcdf}(-E99, 140, 125, 15)$

(−) $\boxed{\text{2nd}}\boxed{,}$

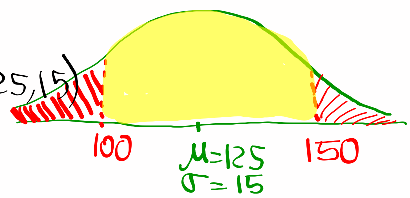


$= \boxed{.841}$

Find $P(x < 100 \text{ OR } x > 150)$

$= 1 - P(100 < x < 150)$

$= 1 - \text{normalcdf}(100, 150, 125, 15)$

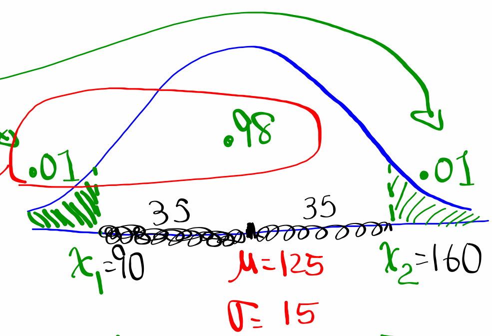


$= \boxed{.096}$

Find two x-values that separate the middle 98% from the rest. Round to whole #.

$1 - .98 = .02$

$.02 \div 2 = .01$



$x_1 = \text{invNorm}(.01, 125, 15) = 90.105 \approx \boxed{90}$

$x_2 = \text{invNorm}(.99, 125, 15) = 159.895 \approx \boxed{160}$

Make sure to have SG 18 & 19 with you tomorrow so we can finish them.