Statistics
Lecture 10

Feb 19-8:47 AM

Binomial Prob. dist. (SG 16)

If you make random guesses on a True/false exam with 100 questions,

$n = 100$, $p = .5$, $q = .5$

Mean $\mu = np = 100(.5) = 50$

Variance $\sigma^2 = npq = 100(.5)(.5) = 25$

standard deviation $\sigma = \sqrt{\sigma^2} = \sqrt{25} = 5$

Usual Range $\mu \pm 2\sigma = 50 \pm 2(5)$

$= 50 \pm 10$

$\Rightarrow \boxed{40 \text{ To } 60}$

Jul 15-4:30 PM

What is the Prob. that we randomly guess at most 60 questions correctly?

$P(x \leq 60) = \text{binomcdf}(100, .5, 60)$

$= \boxed{.982}$

What is the prob. that we randomly guess at least 45 correct ans.?

$P(x \geq 45) = 1 - P(x \leq 44)$

we don't want | we want

want 44 45

$= 1 - \text{binomcdf}(100, .5, 44)$

$= \boxed{.864}$

Jul 15-4:34 PM

What is the prob. that we randomly guess correctly between 40 & 60 inclusive?

$P(40 \leq x \leq 60) = \text{binomcdf}(100, .5, 60) -$

$\text{binomcdf}(100, .5, 39)$

$= \boxed{.965}$

Jul 15-4:40 PM

Prob. that any patient has a full recovery from certain operation is 80%.
125 patients were randomly selected for this procedure.

$n = 125$ $\quad p = .8$ $\quad q = .2$

$\mu = np$
$= 125(.8)$
$= \boxed{100}$

$\sigma^2 = npq$
$= 125(.8)(.2)$
$= \boxed{20}$

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

Usual Range
"95% Range"

$\mu \pm 2\sigma = 100 \pm 2(4.5)$
$= 100 \pm 9$
$\Rightarrow \boxed{91 \text{ to } 109}$

Jul 15-4:45 PM

Find the prob. that $\boxed{\text{exactly } 100}$ of them have full recovery.

$P(x = 100) = \text{binompdf}(125, .8, 100)$

$= \boxed{.089}$

Find the prob. that fewer than 100 have full recovery.

$P(x < 100) = P(x \le 99)$
$= \text{binomcdf}(125, .8, 99)$
$= \boxed{.447}$

Jul 15-4:51 PM

Find the prob. that more than 100 of them have full recovery.

$P(x > 100) = P(x \geq 101) = 1 - P(x \leq 100)$

we don't want — 100 | 101 — we want

$= 1 - \text{binomcdf}(125, .8, 100)$

$= \boxed{.464}$

Jul 15-4:55 PM

Find the prob. that between 91 and 109 of them have full recovery.

Inclusive

$P(91 \leq x \leq 109) = \text{binomcdf}(125, .8, 109)$

$- \text{binomcdf}(125, .8, 90)$

Reduce by 1

$= \boxed{.967}$

Jul 15-4:58 PM

Consider a binomial Prob. dist with $n = 400$ ξ $p = .8$.

1) $q = .2$

2) $\mu = np$
$= 320$

3) $\sigma^2 = npq$
$= 64$

4) $\sigma = \sqrt{\sigma^2} = 8$

5) 68% Range $\Rightarrow \mu \pm \sigma$
$= 320 \pm 8 \rightarrow \boxed{312 \text{ To } 328}$

6) $P(312 \le x \le 328) = \text{binomcdf}(400, .8, 328) - \text{binomcdf}(400, .8, 311)$
$= \boxed{.712}$

95% Range
Usual Range

7) $P(\underbrace{304 \le x \le 336}) = \text{binomcdf}(400, .8, 336) - \text{binomcdf}(400, .8, 303)$ $\rightarrow \boxed{.961}$

Jul 15-5:04 PM

SG 17

Geometric Prob. Dist.

ξ

Poisson Prob. Dist.

Watch the videos on the right-hand side of SG 17, and do them.

You earn double-Points.

Jul 15-5:14 PM

(SG 18-21)

Continuous Random Variable
Measureable

1) Uniform Prob. dist.

2) Standard Normal Prob. dist.

3) Normal Prob. dist.

4) Central - Limit Theorem

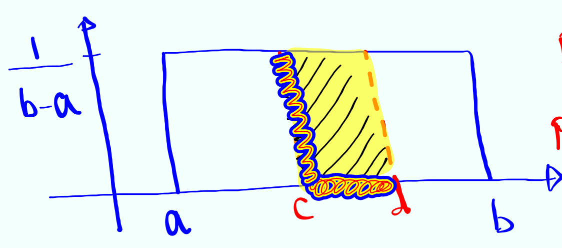
5) Applications

Jul 15-5:18 PM

Uniform Prob. dist.

Let x be a continuous random variable for all values from a to b with a uniform Prob. dist.

1) Graph will be rectangular from a to b with width $\frac{1}{b-a}$.



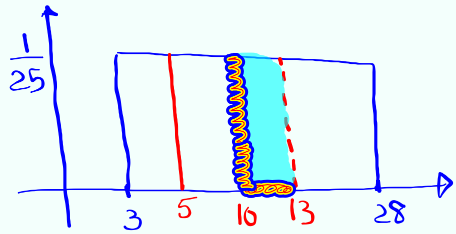
$P(x=c)=0$

$P(c<x<d)$

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

Jul 15-5:21 PM

Consider a uniform Prob. dist. for all values from 3 to 28.



$P(x=5)=0$

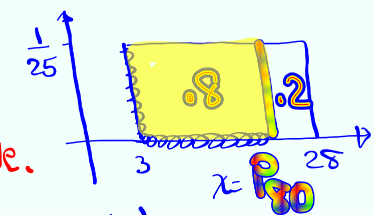
$P(10<x<13)$

$=(13-10)\cdot\frac{1}{25}=\boxed{\frac{3}{25}}=\boxed{.12}$

Find $x=P_{80}$

80% below

20% above.



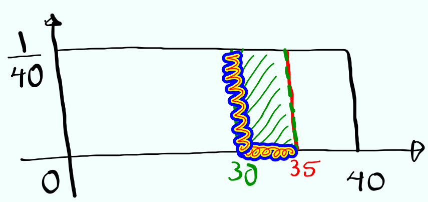
$(x-3)\cdot\frac{1}{25}=.8$

$x-3=25(.8)$

$x-3=20 \rightarrow \boxed{x=23}$

Jul 15-5:26 PM

Soda Machines have a Uniform prob. dist. to get 40 oz of Soda.

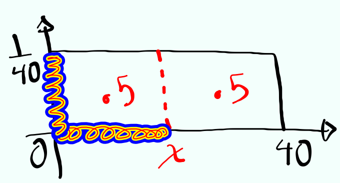


$P(\text{get exactly } 35 \text{ oz})=0$

$P(\text{get between } 30 \,\&\, 35 \text{ oz of drink})$

$=(35-30)\cdot\frac{1}{40}=\frac{5}{40}=\frac{1}{8}=\boxed{.125}$

Find the Median.



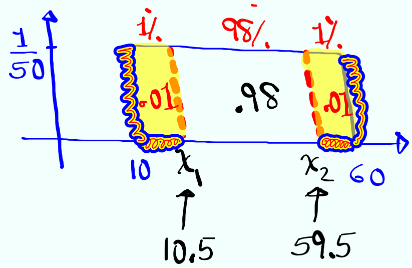
$(x-0)\cdot\frac{1}{40}=.5$

$x=40(.5) \rightarrow \boxed{x=20}$

Jul 15-5:34 PM

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

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



$$(x_1 - 10) \cdot \frac{1}{50} = .01$$

$$x_1 - 10 = 50(.01)$$

$$x_1 - 10 = .5$$

$$\boxed{x_1 = 10.5}$$

$$(60 - x_2) \cdot \frac{1}{50} = .01$$

$$60 - x_2 = 50(.01)$$

$$60 - x_2 = .5$$

$$60 - .5 = x_2 \rightarrow \boxed{x_2 = 59.5}$$

Jul 15-5:50 PM

Standard Normal Prob. Dist.

1) We use Z. $P(Z = c) = 0$

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

3) Mean = Mode = Median

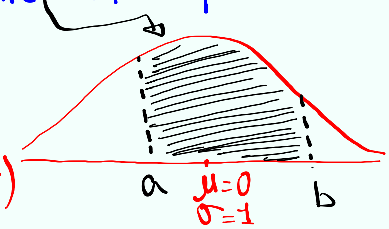
4) $\mu = 0$, $\sigma = 1$

5) $\boxed{P(a < Z < b)}$ is the corresponding area within the bell-shape curve.

How to find it.

2nd VARS

normalcdf(L, U, μ, σ)



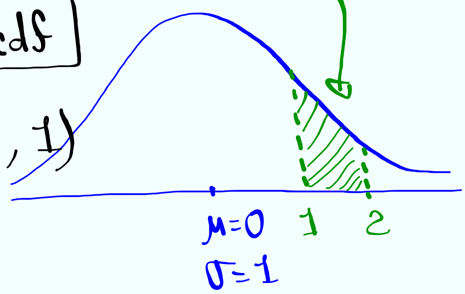
Jul 15-5:57 PM

find $P(1 < Z < 2)$

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

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

$= \boxed{.136}$

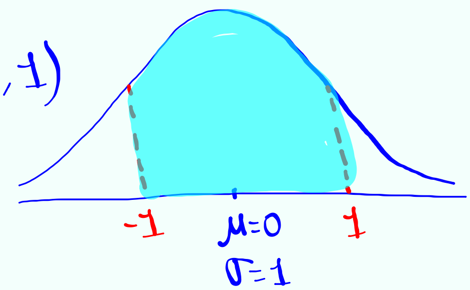


find $P(-1 < Z < 1)$

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

$(-)$

$= \boxed{.683}$



Jul 15-6:03 PM

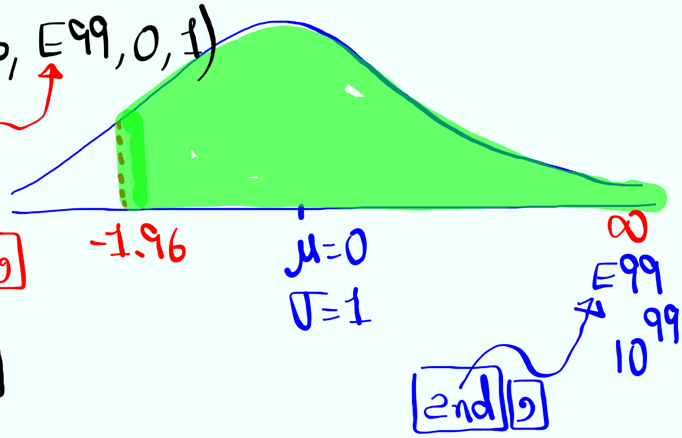
find $P(Z > -1.96)$

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

$(-)$

$\boxed{\text{2nd}}$ $\boxed{9}$

$= \boxed{.975}$



Jul 15-6:10 PM

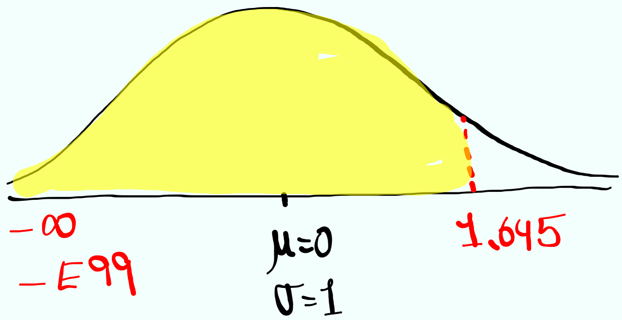
Find $P(z < 1.645)$

$= \text{normalcdf}(-E99, 1.645, 0, 1)$

(-)

2nd ,

$= \boxed{.950}$

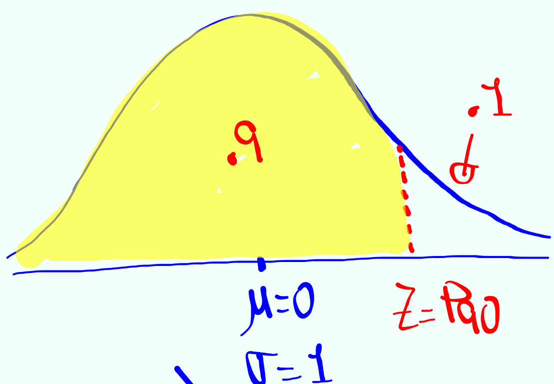


Jul 15-6:15 PM

Find $z = P_{90}$

90% below

10% above



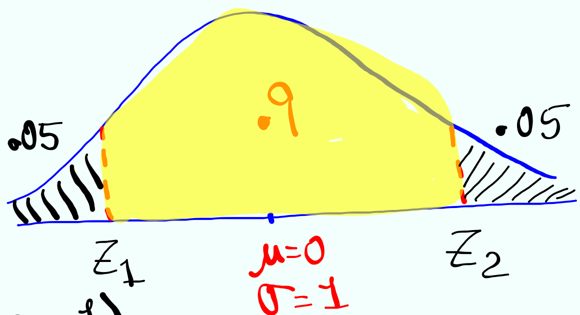
$z = \text{invNorm}(\underset{\substack{\uparrow \\ \text{Left Area}}}{.9}, \underset{\mu}{0}, \underset{\sigma}{1}) = \boxed{1.282}$

Jul 15-6:18 PM

Find two Z-Values that separate the middle 90% from the rest.

$Z_1 = \text{invNorm}(.05, 0, 1)$

$= \boxed{-1.645}$



$Z_2 = \text{invNorm}(.95, 0, 1)$

$= \boxed{1.645}$

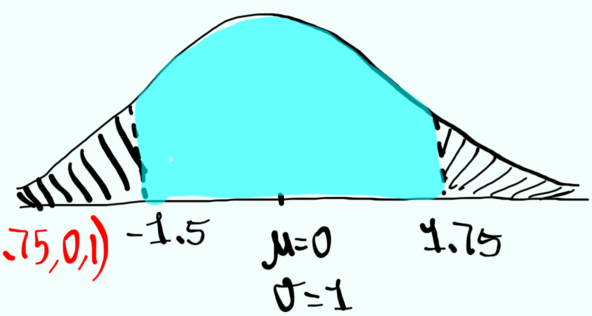
Jul 15-6:21 PM

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

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

↑

Total Area



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

$= \boxed{.107}$

Jul 15-6:25 PM

Normal Prob. dist.:

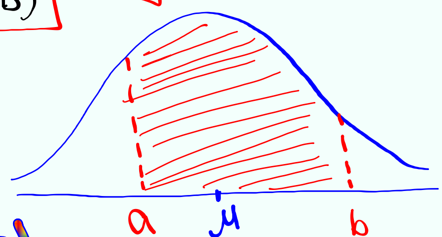
1) use x, $P(x=c)=0$

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

3) Mean = Mode = Median

4) μ & σ are given in the problem.

5) $\boxed{P(a<x<b)}$



use normalcdf
&
invNorm

$N(\mu, \sigma)$

Jul 15-6:31 PM

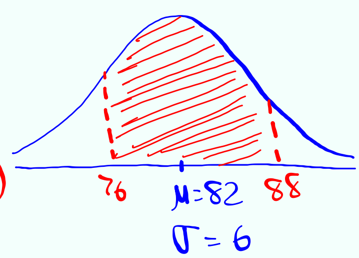
Given $N(82, 6)$

Normal μ σ

$P(76<x<88)$

$=\text{normalcdf}(76, 88, 82, 6)$

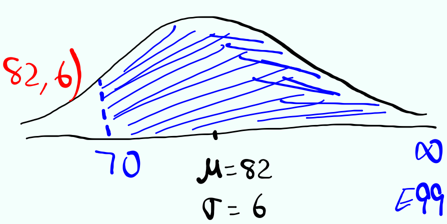
$= \boxed{.683}$



$P(x>70)$

$=\text{normalcdf}(70, E99, 82, 6)$

$= \boxed{.977}$



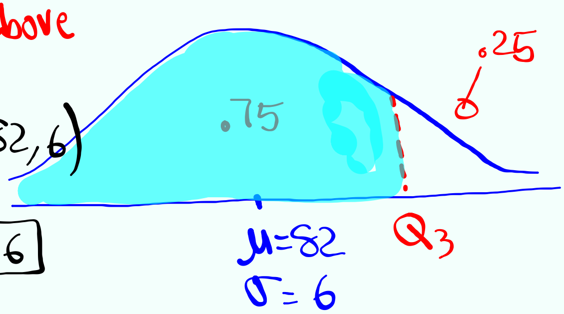
Jul 15-6:36 PM

find $x = Q_3$, Round to whole #

75% below   25% above

$x = Q_3 = \text{invNorm}(.75, 82, 6)$

$= 86.046\ldots \approx \boxed{86}$



Jul 15-6:43 PM

Speed of Cars on 210 FWY are normally dist. with mean of 78 mph and standard dev. of 5 mph.

$N(78, 5)$

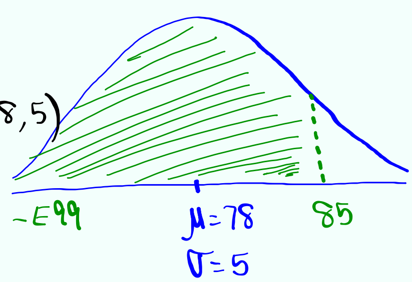
If we randomly Select one car find the prob. that its speed is below 85.

$P(x < 85)$

$= \text{normalcdf}(-E99, 85, 78, 5)$

$= \boxed{.919}$

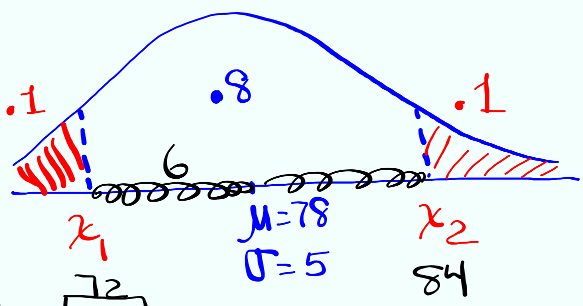
$\approx 92\%$



Jul 15-6:46 PM

Find two speeds that Separate the middle 80% from the rest.

Round to whole#.



$x_1 = \text{invNorm}(.1, 78, 5)$

≈ 72

$x_2 = \text{invNorm}(.9, 78, 5) \approx \boxed{84}$

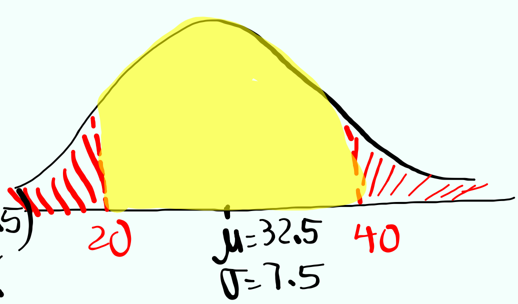
72

Jul 15-6:52 PM

Ages of Students at Mt. SAC are N.D. with $\mu = 32.5$ & $\sigma = 7.5$.

If we select one student, find the Prob. that his/her age is below 20 or above 40.

$P(x<20 \text{ OR } x>40)$



$= 1 - \text{normalcdf}(20, 40, 32.5, 7.5)$

$= \boxed{.206} \approx 21\%$

Jul 15-6:56 PM

Class QZ 6

x	$P(x)$
1	.1
2	.2
3	.5
4	.2

Find

1) $\mu = \boxed{2.8}$

2) $\sigma = \boxed{.9}$

Round to 1-decimal

3) $\sigma^2 = \boxed{\frac{19}{25}}$

Reduced fraction

Jul 15-7:02 PM