Statistics

Lecture 17

Feb 19-8:47 AM

I Surveyed 100 Students.

35 were never late to class

40 " late once

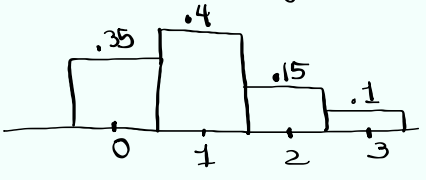
15 " " twice

10 " " 3 times.

# late	P(# late)
0	.35
1	.4
2	.15
3	.1

L1 = #late, L2 = P(#late)

Prob. dist. histogram



#Late → L1

P(#late) → L2

Use [1-Var Stats] with L1 & L2

$\mu = \bar{x} = 1$

$\sigma = \sigma_x = .949$

$n = 1$ ✓

Find σ^2 in reduced fraction

$$\sigma^2 = \frac{9}{10}$$

Oct 23-12:14 PM

Consider a binomial prob. dist. with $n = 100$ and $P = .2$.

1) $q = 1 - P = .8$

2) $\mu = np = 100(.2) = 20$

3) $\sigma^2 = npq = 100(.2)(.8) = 16$

4) $\sigma = \sqrt{\sigma^2} = \sqrt{16} = 4$

5) usual Range $\mu \pm 2\sigma = 20 \pm 2(4) =$ 12 to 28

6) P(exactly 18 Successes)

$P(x = 18) = \text{binompdf}(100, .2, 18) = .094$

Oct 23-12:22 PM

7) P(# of Successes is at most 25)

$P(x \leq 25) = \text{binomcdf}(100, .2, 25)$

$= .913$

8) P(# of Successes is at least 15)

$P(x \geq 15) = 1 - P(x \leq 14)$

$= 1 - \text{binomcdf}(100, .2, 14)$

$= .920$

9) P(# of Successes is between 12 and 28 inclusive)

$P(12 \leq x \leq 28) = \text{binomcdf}(100, .2, 28) - \text{binomcdf}(100, .2, 11)$

Keep

Reduce by 1

$= .967$

Oct 23-12:29 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) Usual Range $\mu \pm 2\sigma = 5 \pm 2(4.5) = 5 \pm 9$ → -4 to 14

6) P(first success happens on 6th attempt)

$P(x=6) = \text{geometpdf}(.2, 6) = \boxed{.066}$

7) P(first success happens before 6th attempt)

$P(x<6) = P(x \leq 5)$

$= \text{geometcdf}(.2, 5) = \boxed{.672}$

Oct 23-12:36 PM

Consider a Poisson Prob. dist with mean of 20 on a fixed interval.

1) $\mu = 20$

2) $\sigma^2 = \mu = \boxed{20}$

3) $\sigma = \sqrt{\sigma^2}$ (one decimal)

$= \sqrt{20} \approx 4.5$

4) Usual Range

$\mu \pm 2\sigma$

$= 20 \pm 2(4.5)$

$= 20 \pm 9$ → $\boxed{11 \text{ to } 29}$

5) P(# of Successes is not 24)

$P(x \neq 24) = 1 - P(x=24)$

$= 1 - \text{PoissonPdf}(20, 24) = \boxed{.944}$

6) P(# of Successes is between 11 and 29 inclusive)

$P(11 \leq x \leq 29) = \text{Poissoncdf}(20, 29) - \text{Poissoncdf}(20, 10)$

$= \boxed{.967}$

SG 16 & 17

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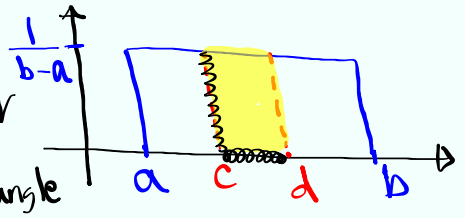
SG 18

Working with Continuous Random Variable

Uniform Prob. dist. for all values from a to b.

Graph is rectangular



The area of this rectangle has to be 1.

$P(x=c)=0$

$P(c<x<d)$ is the area within the graph

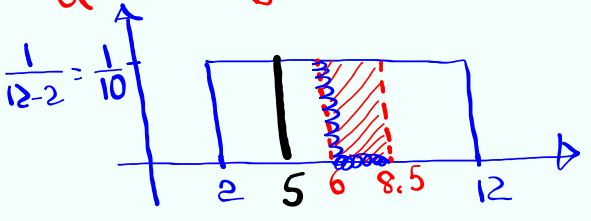
$= (d-c)\cdot\frac{1}{b-a}$

Oct 23-12:55 PM

Consider a uniform Prob. dist. for all values from 2 to 12.

Rectangular graph

a = 2, b = 12



$P(x=5) = 0$

↑ line has 0 area

$P(6<x<8.5)$

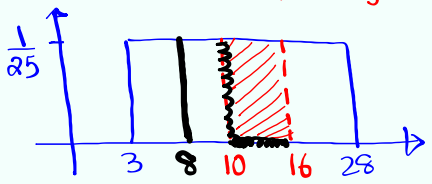
$= (8.5-6)\cdot\frac{1}{10}$

$= 2.5\cdot\frac{1}{10} = \boxed{.25}$

Oct 23-1:01 PM

Consider a Uniform Prob. dist for $3 \le x \le 28$ (a = 3, b = 28)

Rectangular graph



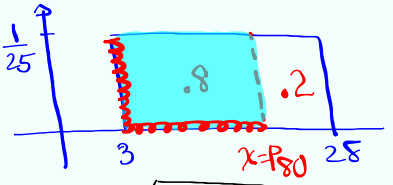
1) $P(x=8) = 0$

2) $P(10<x<16) = (16-10)\cdot\frac{1}{25} = \frac{6}{25} = .24$

3) find $x = P_{80}$

80% below — Left Area .8

20% above — Right Area .2



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

$x-3 = 25(.8)$

$x-3 = 20$

$x = 23$

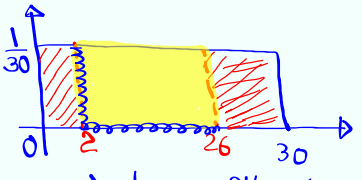
Oct 23-1:05 PM

Consider a uniform Prob. dist. for all values from 0 to 30.

1) $P(x<2 \text{ or } x>26)$

$= 1 - P(2<x<26)$

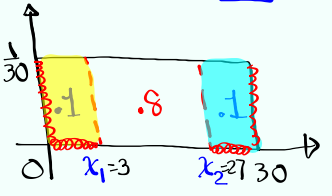
↑ Total Prob



$= 1-(26-2)\cdot\frac{1}{30} = 1-\frac{24}{30} = \frac{6}{30}$

$= .2$

2) Find two x-values that separate the middle 80% from the rest.



$(x_1-0)\cdot\frac{1}{30} = .1$ $\quad x_1 = 30(.1)$ $\quad x_1 = 3$

$(30-x_2)\cdot\frac{1}{30} = .1$ $\quad 30-x_2 = 30(.1)$ $\quad 30-x_2 = 3$ $\quad x_2 = 27$

Oct 23-1:13 PM

Standard Normal Prob. dist.

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

2) Data dist. is symmetric, it has a bell-shape graph with total area 1.

3) Mean = Mode = Median

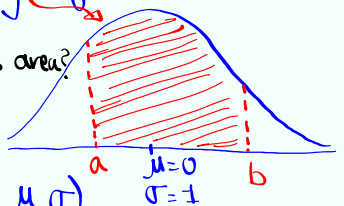
4) $\mu=0$ & $\sigma=1$

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

How do we find this area?

2nd VARS

normalcdf(L, U, μ, σ)



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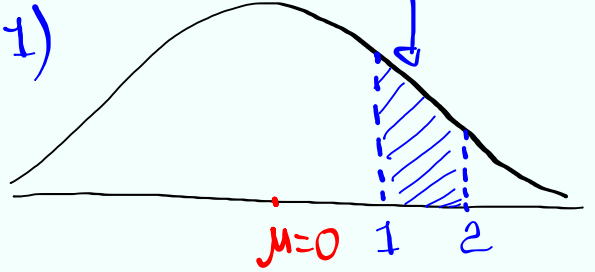
$P(1<Z<2)$

= normalcdf(1, 2, 0, 1)

= .136

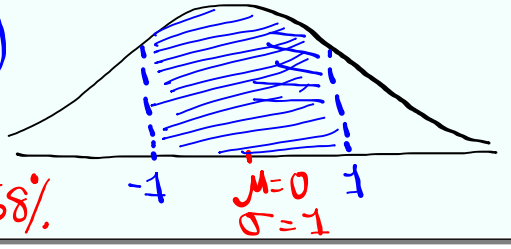


$P(-1<Z<1)$

= normalcdf(−1, 1, 0, 1)

(−)

= .683 ≈ 68%



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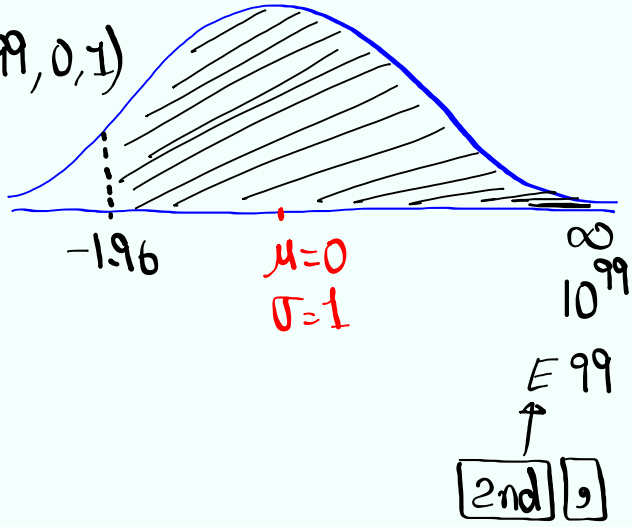
$P(Z > -1.96)$

$= \text{normalcdf}(-1.96, E99, 0, 1)$

(−)

2nd [9]



2nd [9]

$= .975$

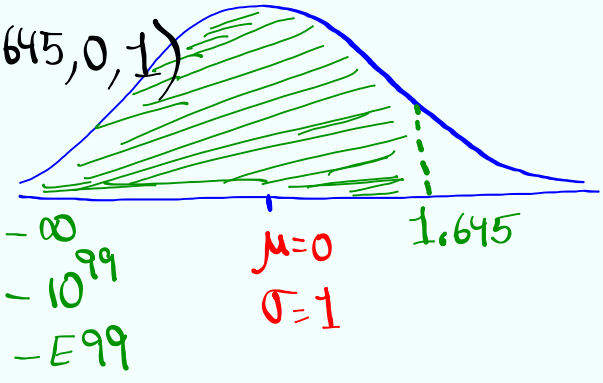
Oct 23-1:52 PM

$P(Z < 1.645)$

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

(−)

2nd [9]



$= .950$

Find $P(Z < -1.5 \text{ and } Z > 1) = 0$

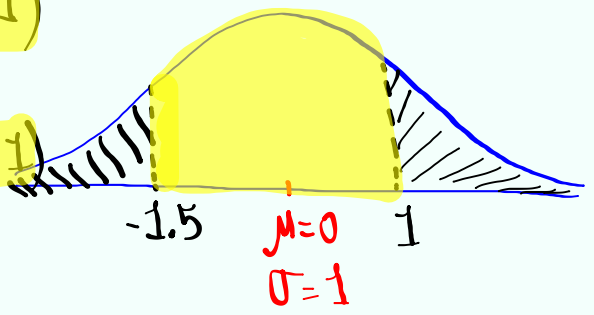
Oct 23-1:55 PM

Find $P(Z < -1.5 \text{ OR } Z > 1)$

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

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

$= .225$



Oct 23-2:00 PM

Find $Z = P_{95}$

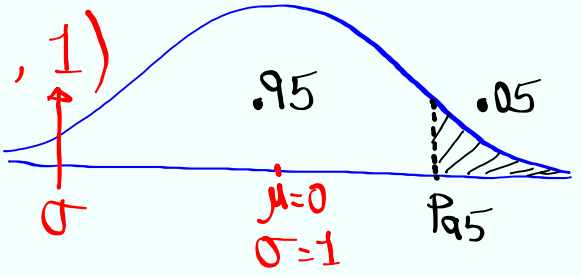
95% below — Left Area .95

5% above — Right Area .05

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

Left Area → .95; 0 → μ; 1 → σ

$= 1.645$



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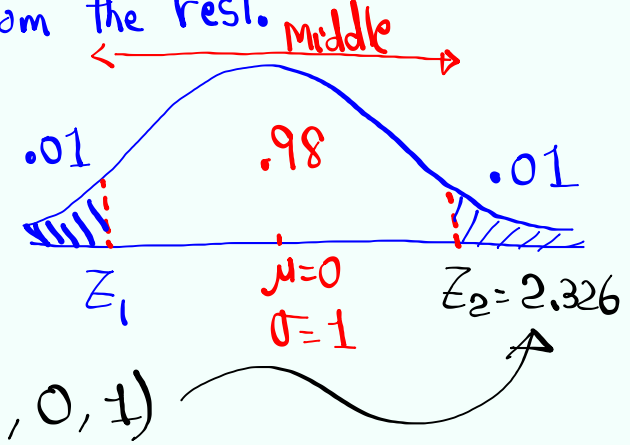
Find two Z-values that separate the middle 98% from the rest.



$Z_1 = \text{invNorm}(.01, 0, 1)$

$= \boxed{-2.326}$

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

Oct 23-2:09 PM

Normal Prob. dist. (SG 19)

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

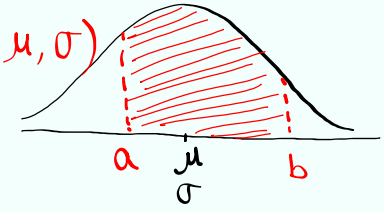
2) Data dist. is symmetric, and bell-shape with total area 1.

3) Mean = Mode = Median

4) μ & σ are given in the problem.

5) $P(a<x<b)$ is the shaded area below

= normalcdf(L, U, μ, σ)



$N(\mu, \sigma)$

↑ Normal

Oct 23-2:14 PM

Given $N(82, 6)$

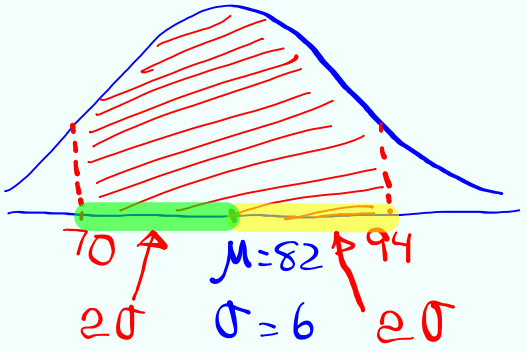
Normal Prob. dist

μ σ

$P(70 < x < 94)$

= normalcdf(70, 94, 82, 6)

= .954 $\approx 95\%$



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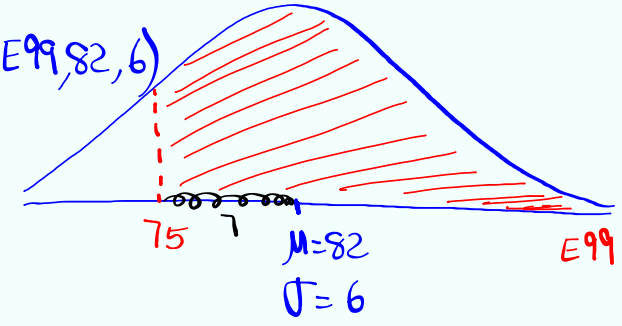
$P(x > 75)$

= normalcdf(75, E99, 82, 6)

= .878

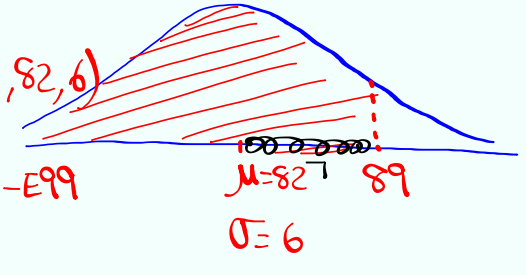


$P(x < 89)$

= normalcdf(−E99, 89, 82, 6)

(−) 2nd [9]

= .878



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Consider the chart below

x	y
12	85
14	88
16	90
16	95
18	100

LinReg(a+bx)

$x \rightarrow$ Qz Scores L1

$y \rightarrow$ Exam Scores L2

Find

$a = 54.769 \approx 55$

$b = 2.423 \approx 2$

$r^2 = .865 \approx 87\%$

$r = .930$

Predict Y if $x = 15$

1) Assume r is Significant

$y = 55 + 2x = 55 + 2(15) = \boxed{85}$

2) Assume r is not Significant

use $\bar{y} = 91.6 \approx \boxed{92}$

Oct 23-2:30 PM

Use the table below

Use 1-Var Stats

L1 class MP	L2 class F
12	4
20	6
28	10
36	5

Find

1) $\bar{x} = 25.12$

2) $S = 7.960$

3) S^2 (Reduced fraction)

$$\frac{1584}{25}$$

Oct 23-2:37 PM