Panel 1

Last Time

Probability Theory

Normal Distribution

Table p.592

Ex: flip one coin twice:

TT, TH, HT, HH

P(no head) = 1/4

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

3

33

P(4 or more) = 33/36

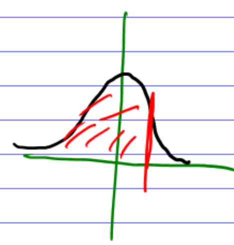
= 11/12 = 92%

1

Panel 2

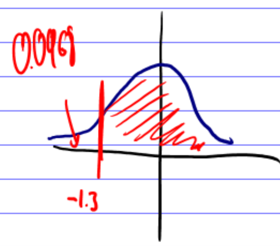
$P(z < 1.2) = 1 - 0.1151$

0.1151



$P(z > -1.3) = 1 - 0.0968$

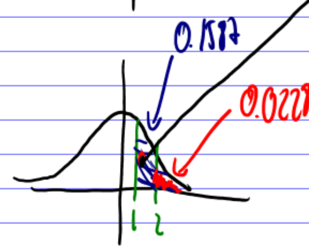
0.0968



$0.1587 - 0.0228$

$P(1 < z < 2) =$

0.1587 0.0228



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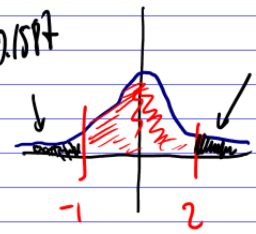
Panel 3

$P(-1 < z < 2)$

(+1) $\quad$ 0.1587 $\quad$ 0.0228



$= 1 - (0.1587 + 0.0228)$

Note: The Standard Normal Distribution has mean $\mu = 0$ and std. dev. $\sigma = 1$. We denote it as $N(0,1)$

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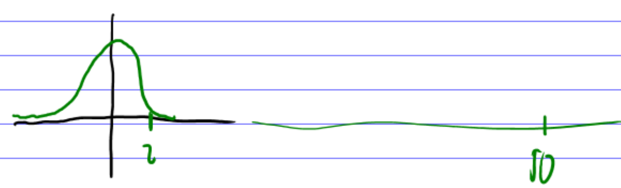
Panel 4

What is the prob. that a random person is 50 years or older?

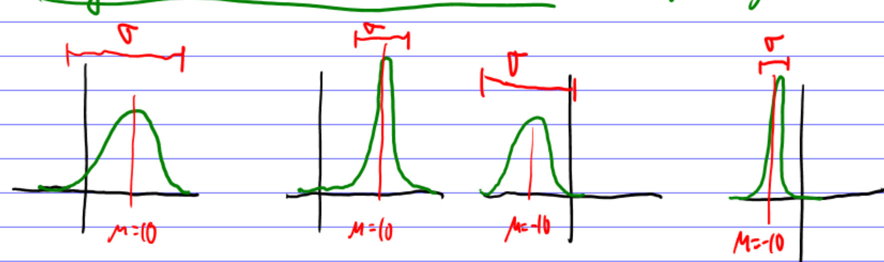
$P(x \geq 50)$, x is age.

Look up 50 on p. 542

$\Rightarrow 0!$



Many different normal distributions with different μ and σ



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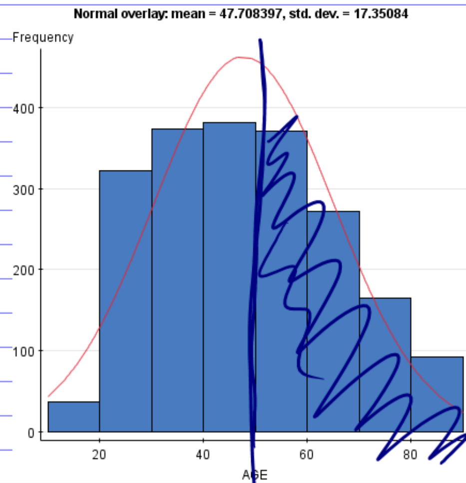
Panel 5

Let's denote $N(\mu, \sigma)$ be a normal distr. with mean μ and std. dev. σ.

Q: Which $N(\mu, \sigma)$ do I use for my age problem?

Use GSS survey:



Use $N(47.7, 17.3)$

it will fit best

$P(X \geq 50) \approx 0.45$ (guess)

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Panel 6

To use our table, I need to convert $N(47.7, 17.3)$ to $N(0,1)$.

Finding the z-score: If x has a $N(\mu, \sigma)$ normal distr, then the corresponding z-score is

$$z = \frac{x - \mu}{\sigma}$$

That z-score is $N(0,1)$.

0.4483

$\Rightarrow P(X \geq 50) = P(z \geq 0.1329) = 0.4483$ or 44.8%

z-score for 50: $\frac{50 - 47.7}{17.3} = 0.1329$

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Panel 7

Typical Problem: Suppose X is a variable that has a normal distr. with $\mu = 6$ and $\sigma = 2$, $N(6, 2)$. Find

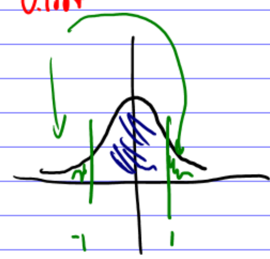
$$P(4 < X < 8) = P(-1 < z < 1) = 1 - 2 \cdot 0.1587 = \underline{0.6826}$$

0.1587

$X = 4$: $\frac{4-6}{2} = -1$

$X = 8$: $\frac{8-6}{2} = 1$

$z = \frac{x - \mu}{\sigma}$



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Panel 8

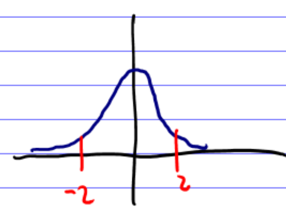
Find the prob. of meeting someone with 4 or more children?

Guess: $2/17 = \underline{0.11}$

$$P(X \geq 4) = P(z \geq 1.21) = \underline{0.1131}$$

GSS: $N(1.94, 1.7)$

$4 \to z$ score: $z = \frac{4 - 1.94}{1.7} = 1.21$



Note: $N(\mu, \sigma) \to N(0, 1)$ is special and called Standard normal dist.

bell-shape   mean   std. dev.

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Panel 9

Goal: We can approximate probabilities using the standard normal distribution, as long as the original distribution is normal, and we know its mean and std deviation.

We are in luck: Central Limit Theorem

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