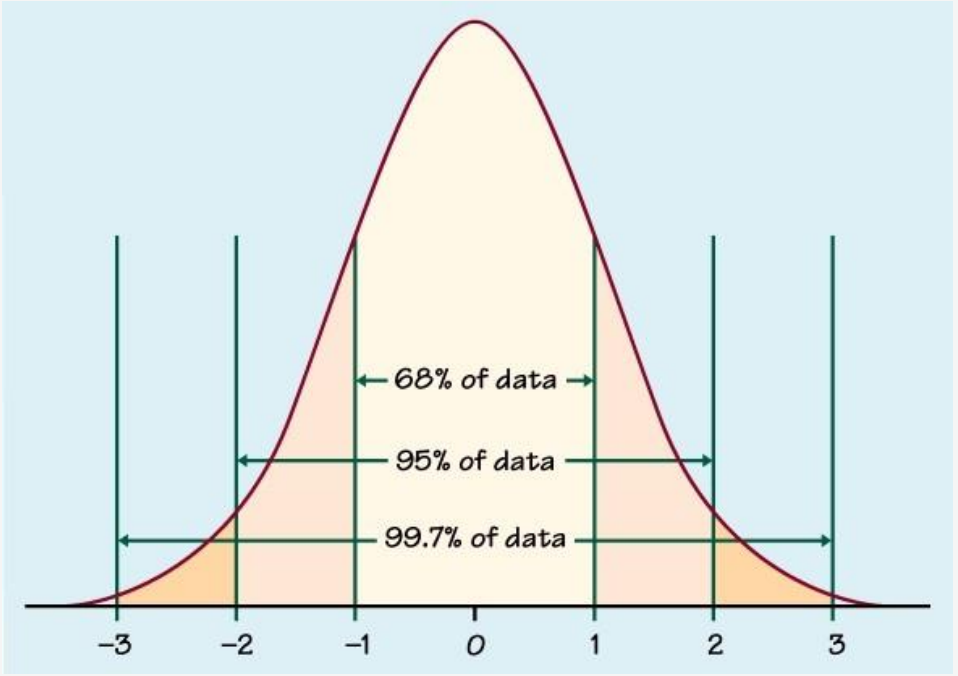
CH. 5 – Probability

PY 221 Research Methods & Statistics I

Dr. Valenti

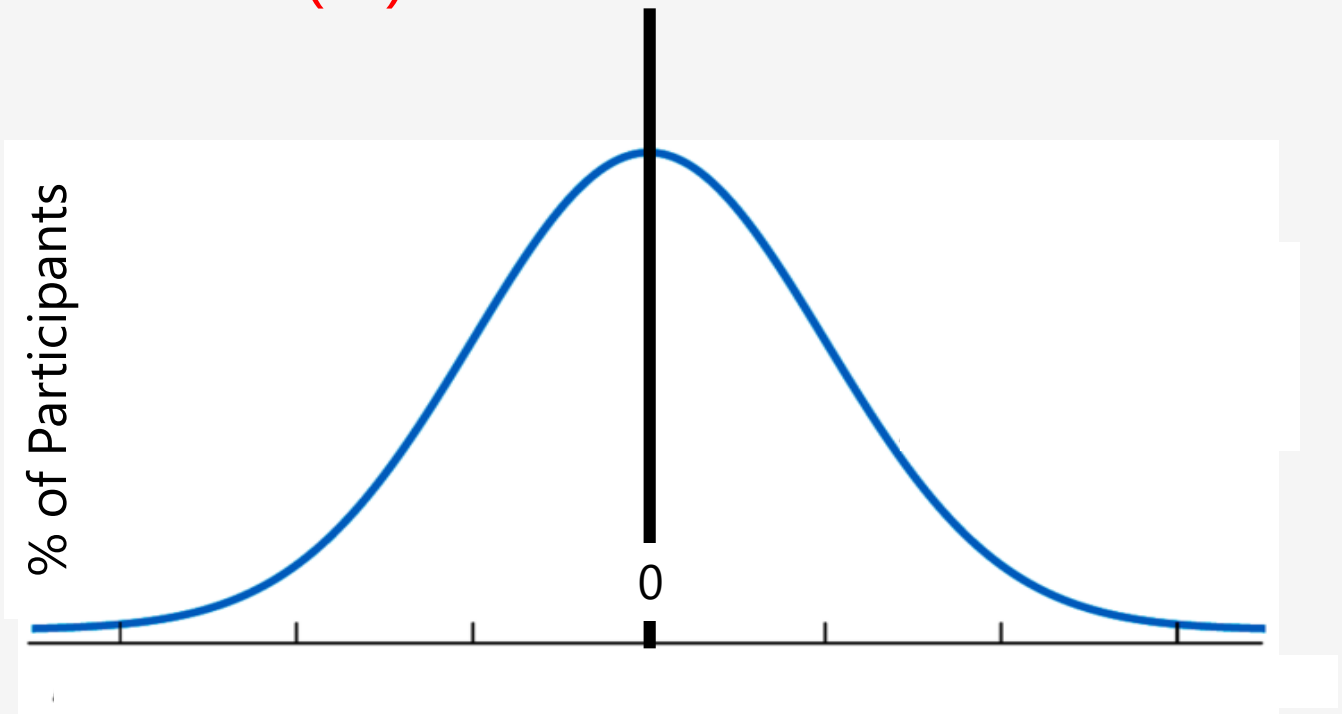
Outline for Ch. 5

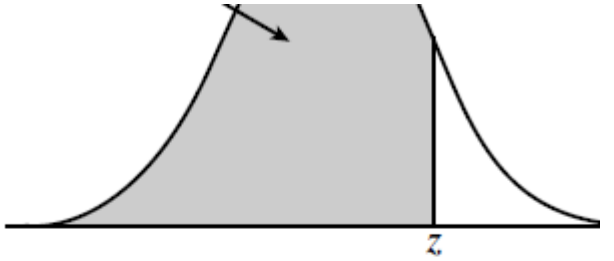
Basically we're just going to practice figuring out probabilities of different scores, using the ***z-table (table of standard normal probabilities)***



z-table (Standard Normal Probabilities Table)

- The first column and top row, of each side, contain values of *z*
- The rest of the numbers (4-digit decimal #s) are *probabilities* (%)



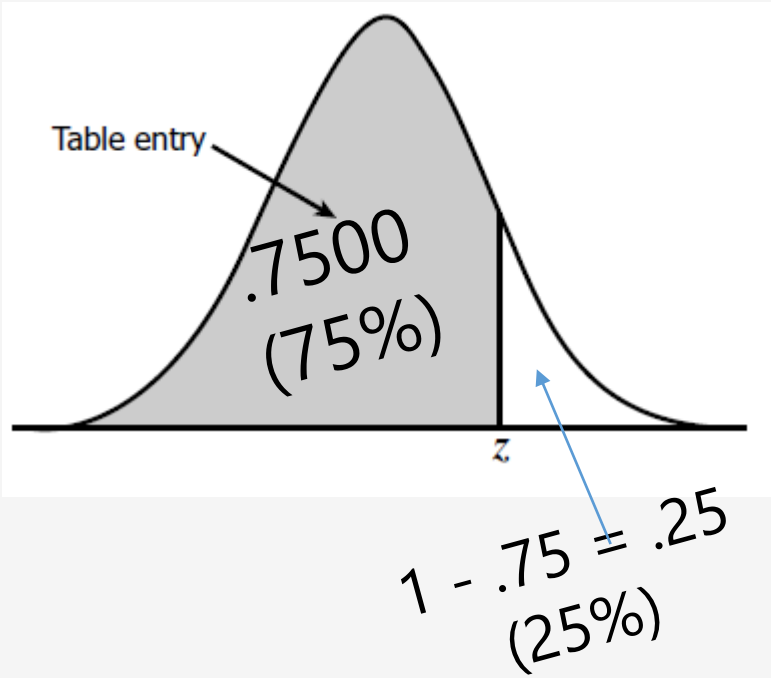


z	.00	.01	.02
0.0	.5000	.5040	.5080
0.1	.5398	.5438	.5478
0.2	.5793	.5832	.5871
0.3	.6179	.6217	.6255
0.4	.6554	.6591	.6628
0.5	.6915	.6950	.6985
0.6	.7257	.7291	.7324
0.7	.7580	.7611	.7642
0.8	.7881	.7910	.7939
0.9	.8159	.8186	.8212
1.0	.8413	.8438	.8461
1.1	.8643	.8665	.8686
1.2	.8849	.8869	.8888
1.3	.9032	.9049	.9066
1.4	.9192	.9207	.9222
1.5	.9332	.9345	.9357
1.6	.9452	.9463	.9474
1.7	.9554	.9564	.9573
1.8	.9641	.9649	.9656
1.9	.9713	.9719	.9726
2.0	.9772	.9778	.9783
2.1	.9821	.9826	.9830

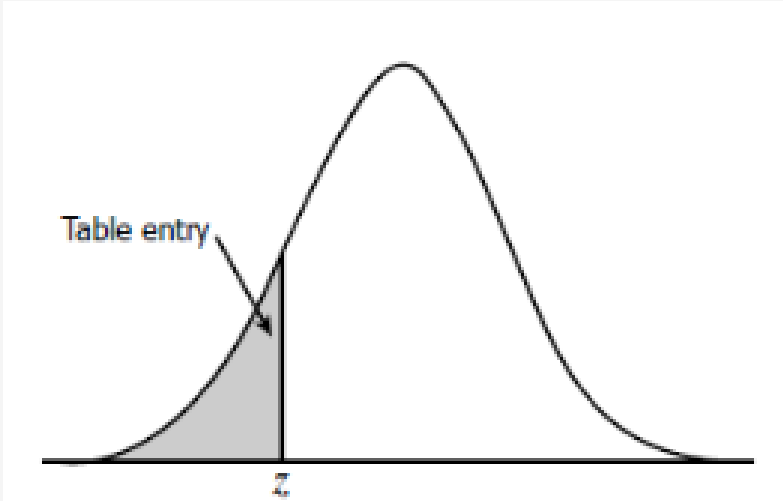
z-table (Standard Normal Probabilities Table)

- Positive z side
- Negative z side

For both sides of the sheet, the decimal values in the middle indicate the area under the standard normal curve to the **left** of *z* (i.e., the % of Ps who fall ***below*** that z-score).



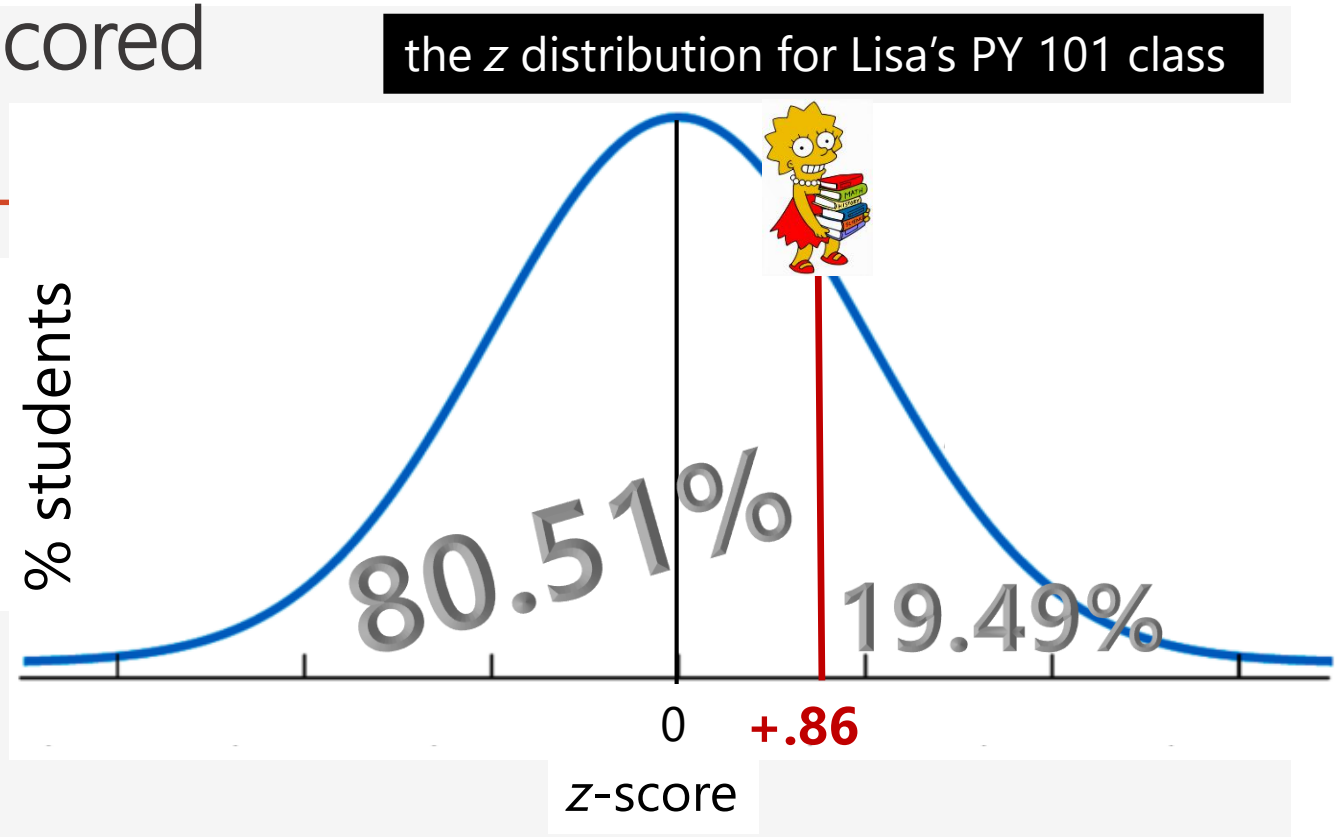
If you need to know the percentage of scores that are *greater* than a given z-score, simply subtract the probability given in the table from 1.00.



What % of PY 101 classmates scored better & worse than Lisa?

- Reminder: *Lisa's raw score was 76, and her z-score was +.86.*
- This indicates that her 76 is .86 standard deviations above the class mean.
- What % of PY 101 classmates fall **above** and **below** a *z*-score of +.86?

Look in table of standard normal probabilities (z-table)…



Answer

80.51% of students have scores that fall *below* Lisa's

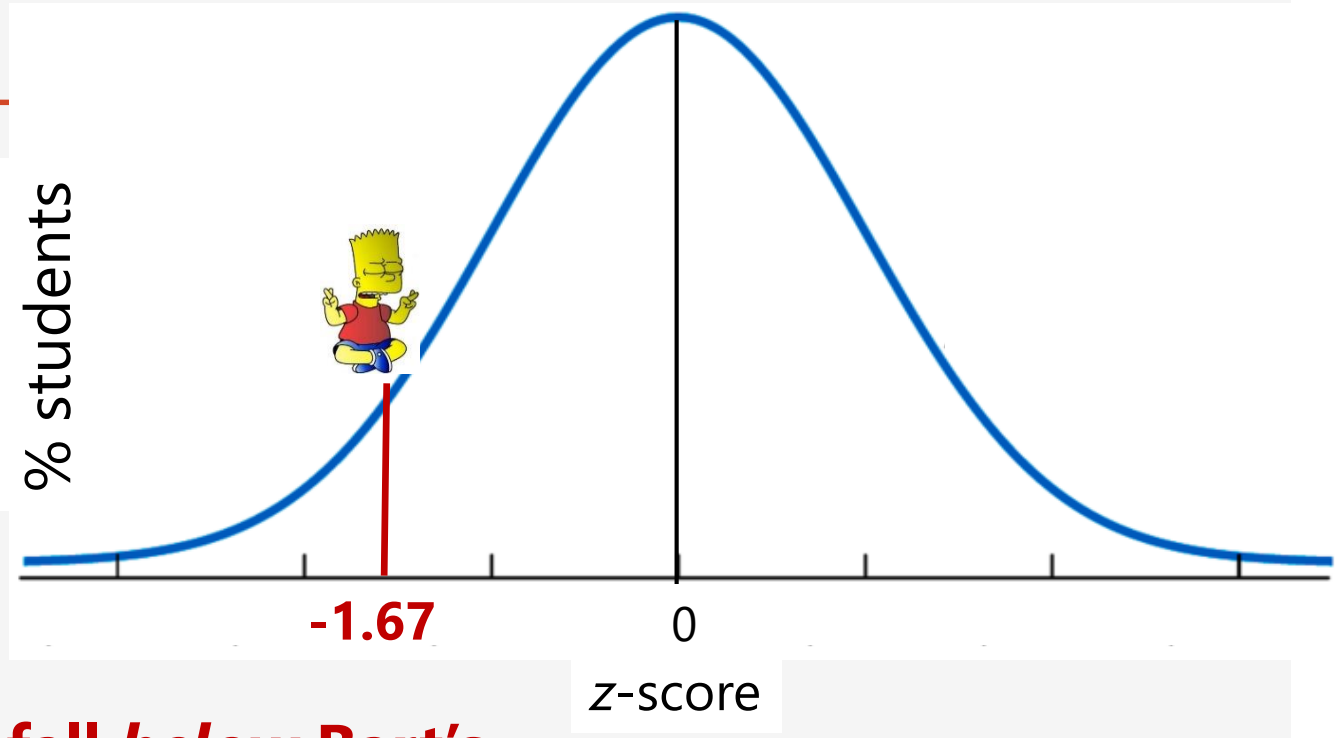
Lisa scored higher than 80.51% of her classmates.

19.49% of students have scores that are *above* Lisa's

Lisa scored worse than 19.49% of her classmates.

What % of BI 110 classmates scored better & worse than Bart?

- Reminder: *Bart's raw score was 65, and his z-score was -1.67.*
- What % of BI 110 classmates fall above and below a *z*-score of -1.67?



Answer

4.75% of students have scores that fall *below* Bart's

Bart is in the bottom 4.75% of students

95.25% of students have scores that are *above* Bart's

Bart performed worse than 95.25% of his classmates.

Look in table of standard normal probabilities (z-table)…

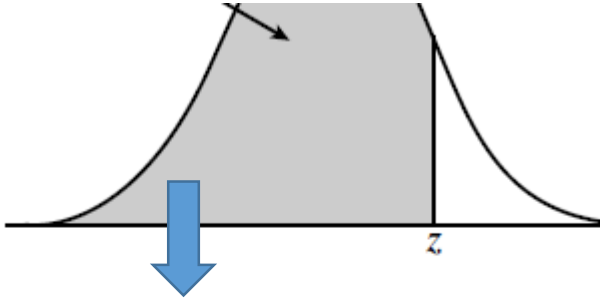
Practice using z-scores (p. 2 of handout)

Q1: Lisa's score of 76 is 2.00 standard deviations above the class mean in BI 110.

- What % of students in BI 110 scored below Lisa? 97.72%
- What % of students in BI 110 scored above Lisa? 2.28%

Q2: Bart's score of 65 is .71 standard deviations below the mean PY 101 score.

- What % of students in PY101 scored below Bart? 23.89%
- What % of students in PY101 scored above Bart? 76.11%



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1.9	[illegible]	.9719	.9726
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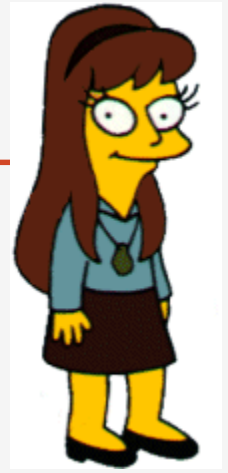
Practice using z-scores (p. 2 of handout)



Q3: Allison earns 78% on BI 110 exam ($M = 70$, $SD = 3$).

- What % of students in BI 110 scored below Allison? 99.62%
- What % of students in BI 110 scored above Allison? 0.38%

$$z = \frac{X - \overline{X}}{s} \qquad z = \frac{(78 - 70)}{3} \qquad z = \frac{8}{3} \qquad z = +2.67$$

z-table gives **.9962** for a z of +2.67

Practice using z-scores (p. 2 of handout)

Q4: The BI 110 instructor wants to know which students are "standout" students, which she should recommend re-take the course, and which students don't fit either of these two categories. She decides that the **top 2.5%** of scorers should be considered "standouts" and the **bottom 2.5%** of scorers should retake the course. Which students, if any, are standouts, and which, if any, should retake the course? (Remember that BI 110 *M* = 70, *SD* = 3).

- Allison, with her 78%?
- Lisa, with her 76%?
- Bart, with his 65%?
- Millhouse, with his 60%?

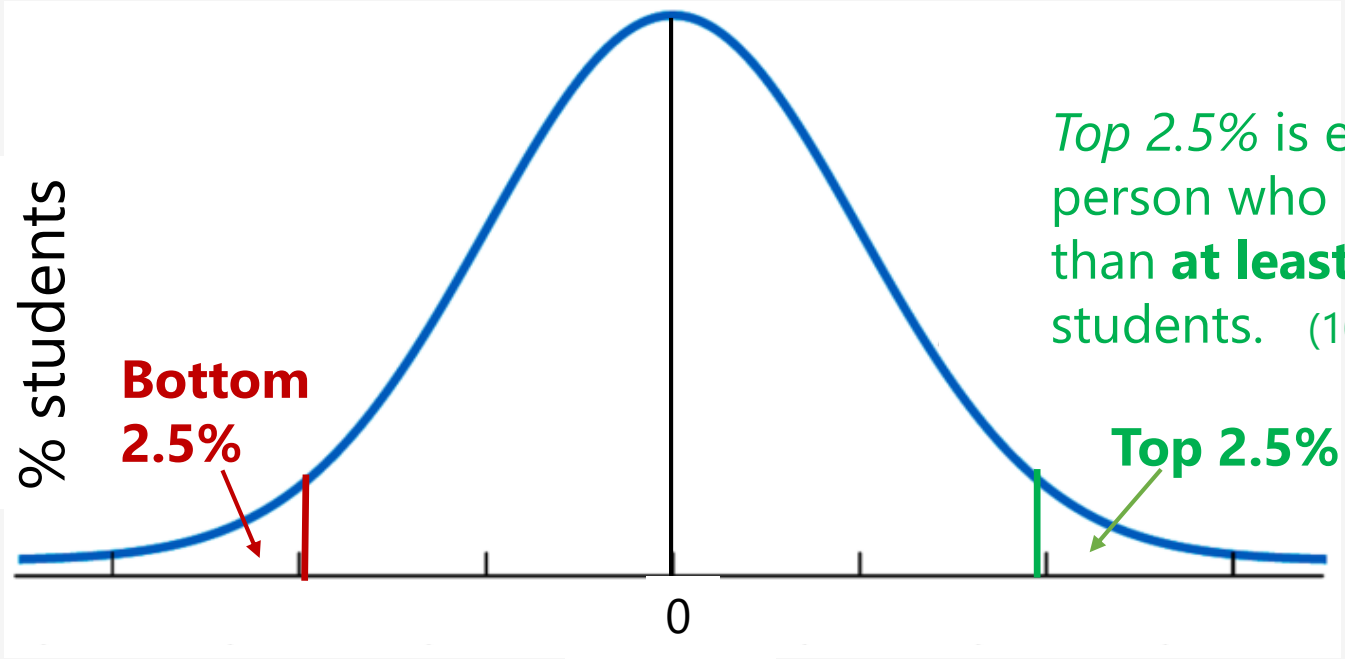
Remember to use some of the information from earlier questions to help you here.

Practice using z-scores

$$z = \frac{X - \overline{X}}{s}$$

Q4: The BI 110 instructor wants to know which students are "standout" students, which she should recommend re-take the course, and which students don't fit either of these two categories. She decides that the **top 2.5%** of scorers should be considered "standouts" and the **bottom 2.5%** of scorers should retake the course. Which students, if any, are standouts, and which, if any, should retake the course?

Bottom 2.5% is equivalent to a person who performed **worse** than **at least 97.5%** of other students.
(100% - 2.5% = 97.5%)



Top 2.5% is equivalent to a person who performed **better** than **at least 97.5%** of other students. (100% - 2.5% = 97.5%)

Practice using z-scores – *to review*

Q4:

- Allison, with her 78% - she's in the top 0.38%
- Lisa, with her 76% - she's in the top 2.28%

Both are in the top 2.5% of class, meaning both are "standouts".

- Bart, with his 65% - he's in the *bottom* 4.75%.

Not good enough to be a "standout," but not bad enough to have to re-take, either.

- Millhouse, with his 60%

$$z = \frac{(60 - 70)}{3} \quad z = \frac{-10}{3}$$

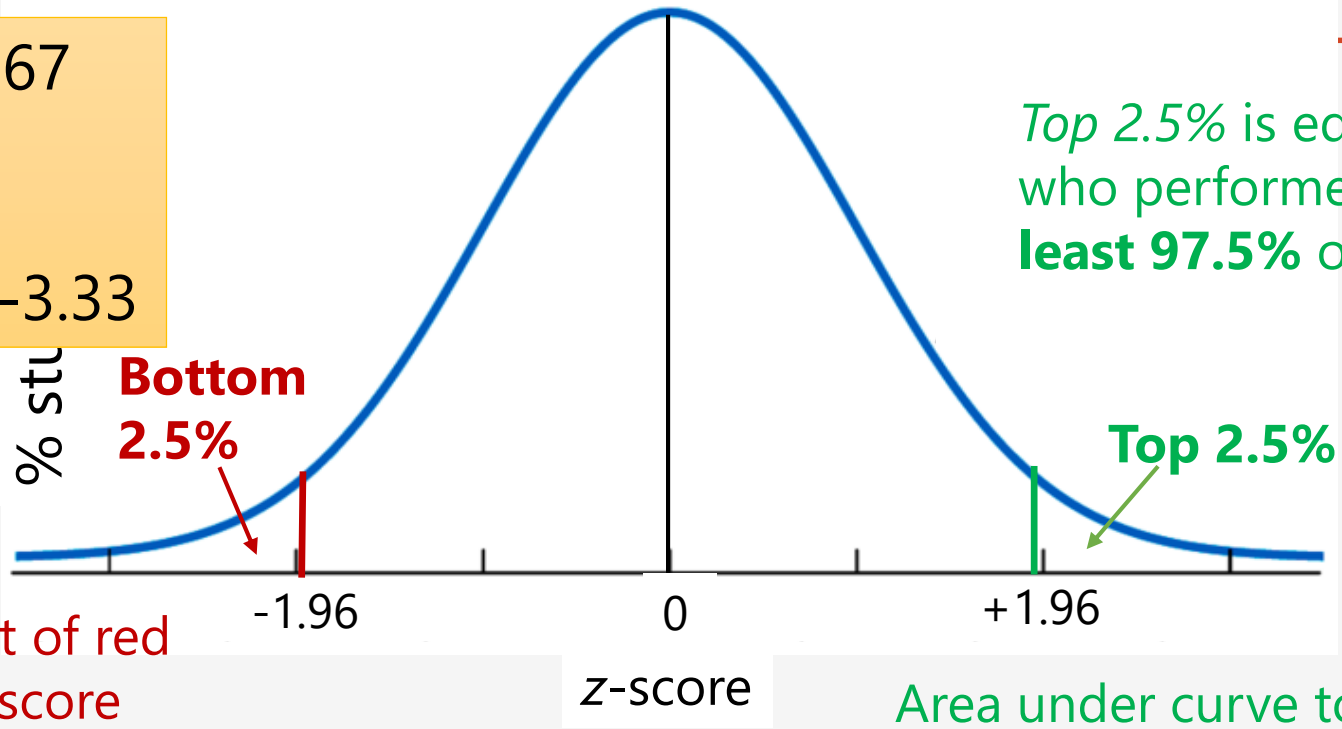
z = -3.33. Go to z-table to look up %.

.0004 → Only 0.04% of class scored below Millhouse,
meaning he'll have to retake the course; he <u>is</u> in bottom 2.5%

Another way to solve Q4

$$z = \frac{X - \overline{X}}{s}$$

Allison's z-score = +2.67
Lisa's z-score = +2.00
Bart's z-score = -1.67
Millhouse's z-score = -3.33



Top 2.5% is equivalent to a person who performed **better** than **at least 97.5%** of other students.

Area under curve to the left of red line = .0250. What is the z-score associated with that probability?

z = -1.96

Any student with a z-score **below** -1.96 is a "retaker".

Area under curve to the left of green line = .9750. What is the z-score associated with that probability?

z = +1.96

Any student with a z-score **above** 1.96 is a "standout".

Pixar z-score activity

- Complete this on your own for rest of class today, and bring it to class on Tuesday as well.
  - You do not have to finish it before Tuesday's class

Upcoming stuff for PY 221

- My goal is to return your Lab 1 assignments, with feedback, by the end of this weekend. Please check your email and follow up with me if you have questions about my feedback.
- Final three block 1 quizzes are next week (need 5 successful quizzes for full credit on block 1 quizzes)
- Lab #2 due on Wednesday by 2:00 pm on Moodle
- I strongly recommend that you complete all of the self-graded HWs (on Moodle) on Ch. 1-5 topics prior to Tuesday's class.
- All next week we will do review exercises to prepare for the 1st exam
  - Feel free to bring your laptop and textbook each day, so that you can have this information accessible to you as you practice.