Analysis of Grades for Enrollment, Graduation and Retention

Presented to Administration Team
University of Wisconsin - Madison

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Why are grades important?

- Grades are a proxy for enrollment
- Grades are a proxy for student success
- Student success is a factor in student retention and graduation rates.

Dataset

9,000 different courses and 200,000 course sections

3,000,000 million grades reported

18,000 instructors

Covers years 2006 - 2017

STEM categories came from NSF and H1-B visa definitions

Only publicly available data. Future analysis should map these results with individual students to confirm results.

Do STEM courses, which may be more difficult, have a different grade distribution than traditional liberal arts courses?

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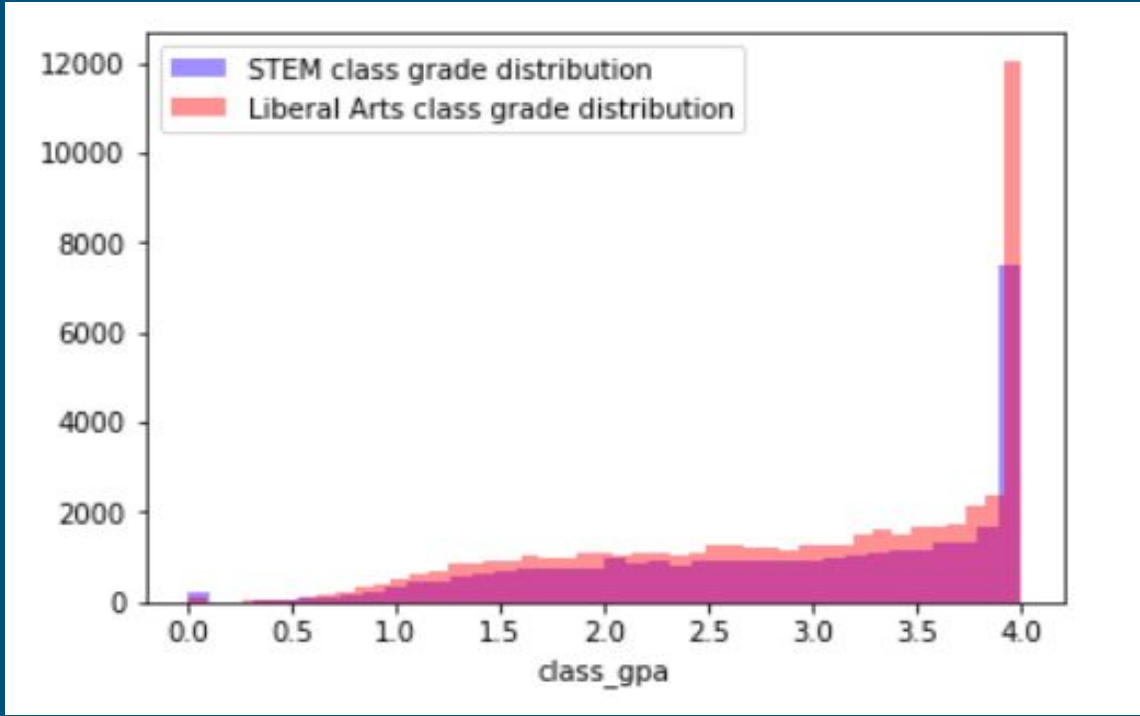
STEM vs. Liberal Arts Grade Distributions



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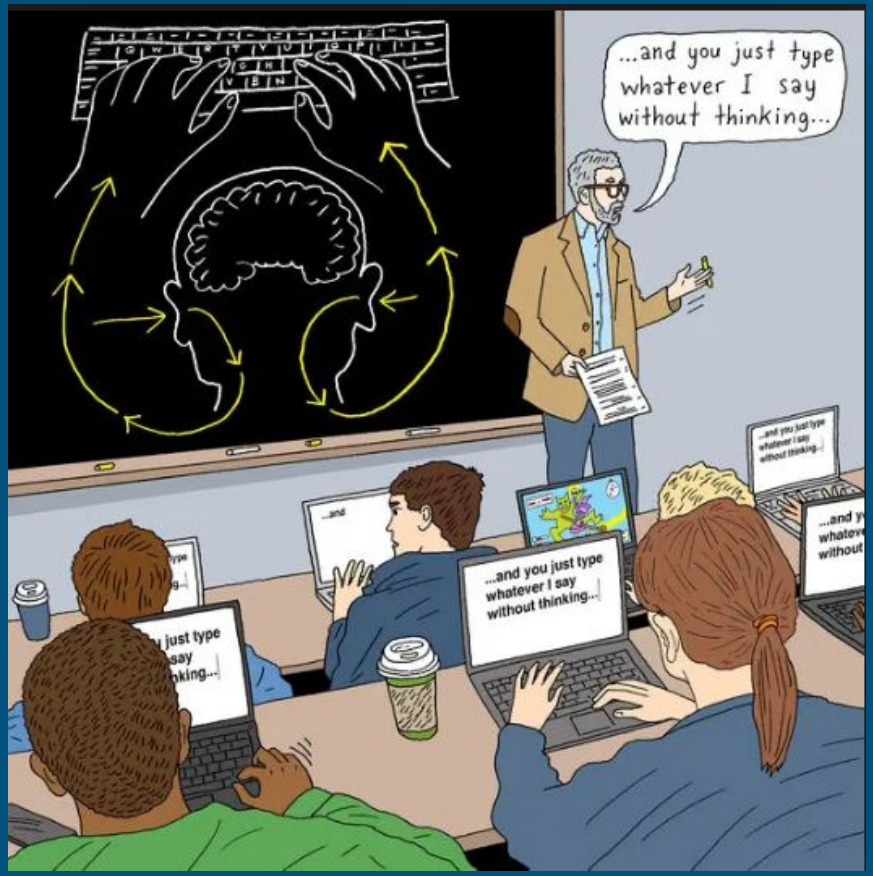

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Do classes which start before noon have a different grade distribution than classes after lunch?

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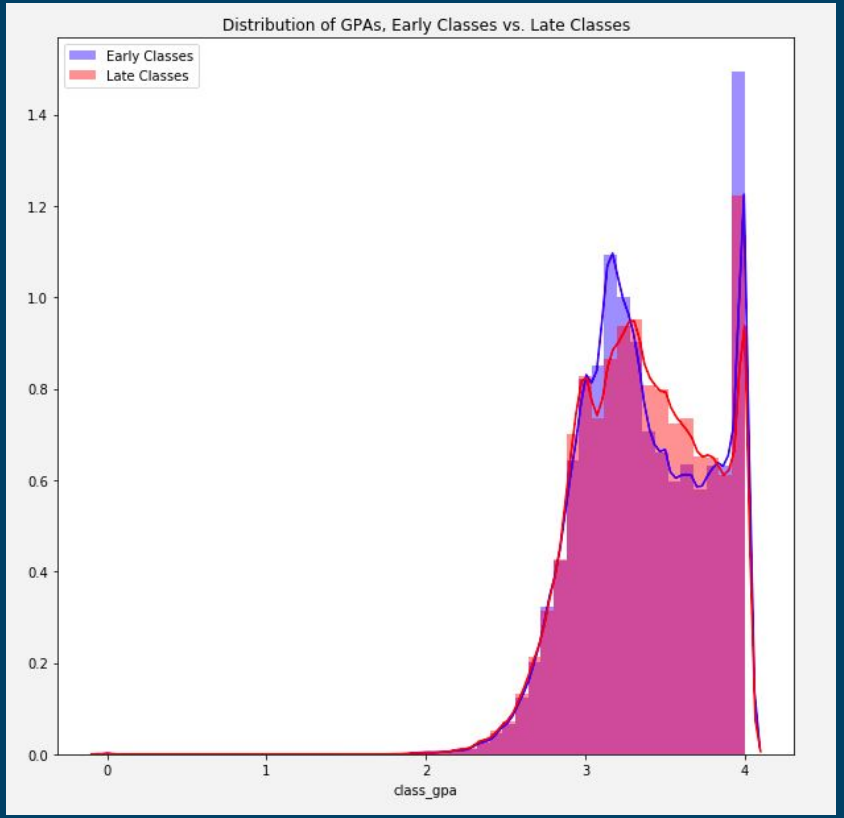
Before Noon and Afternoon Classes

(Power = 3 * 10^16)



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Has there been a change in grade distribution over the past decade?

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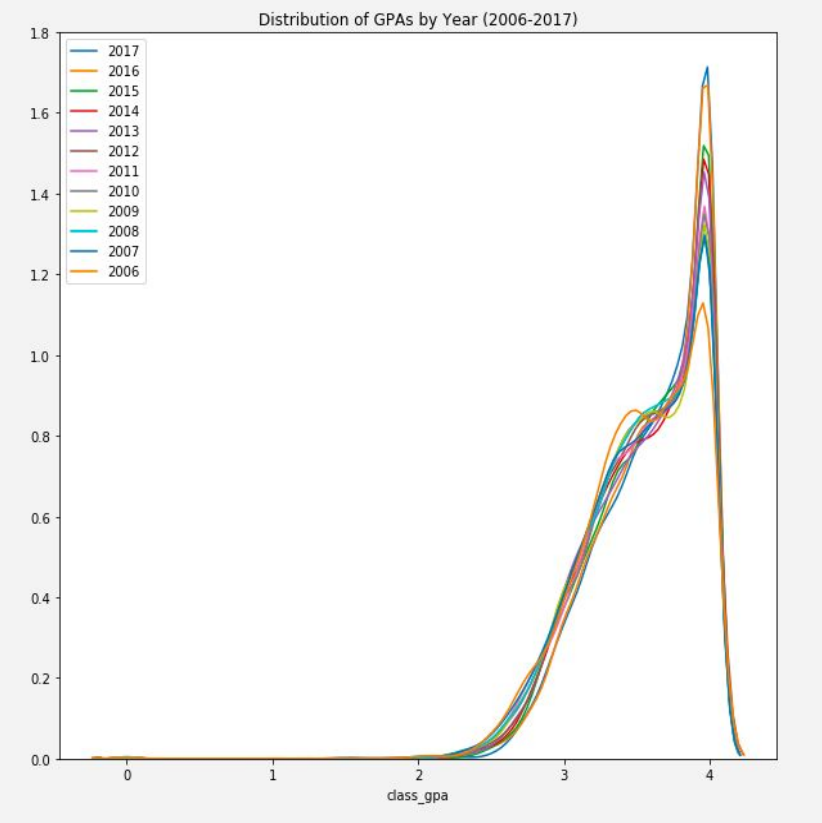
Change of Grade Distribution Annually

2006 Annual GPA - 3.3085
2017 Annual GPA - 3.4154
(annual cumulative GPA)

ANOVA: Class GPA vs. C(year)
$p(f) = 2.9*10^{-93}$



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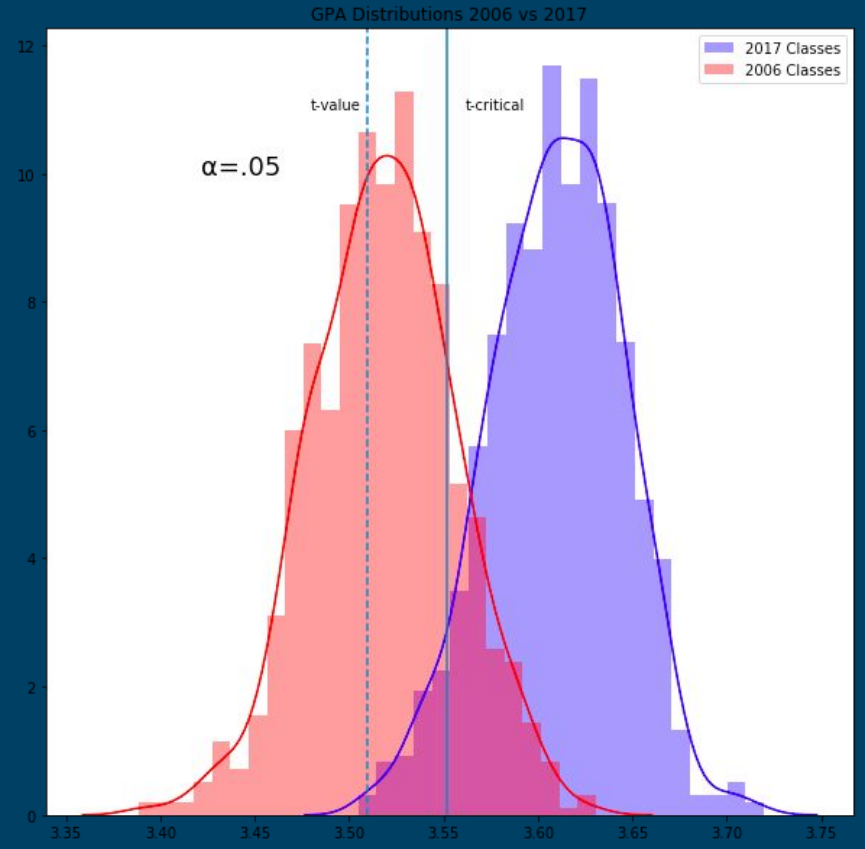
Too Close to Call

P-value < alpha (but just barely)!

Low effect size (.08)



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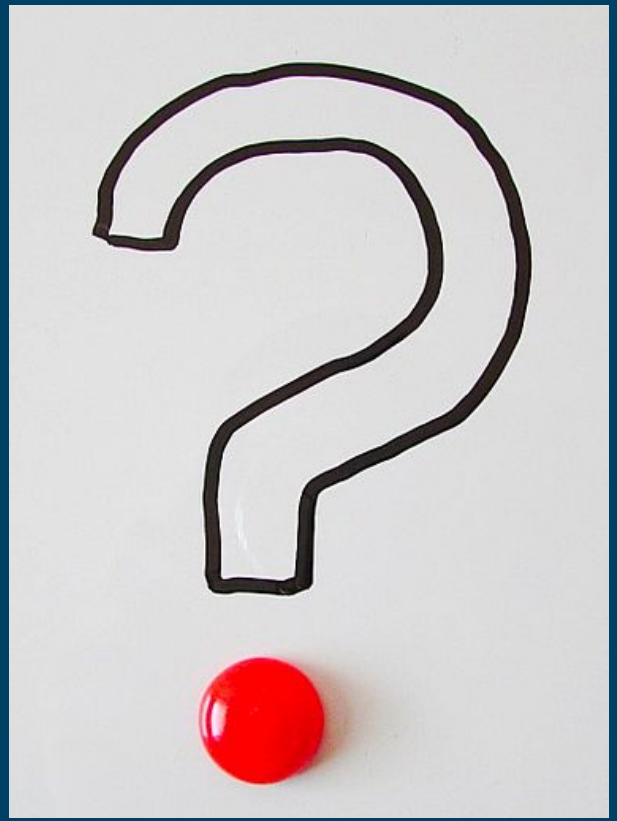
Do large classes (greater than 32 students) have a different grade distribution than smaller classes?



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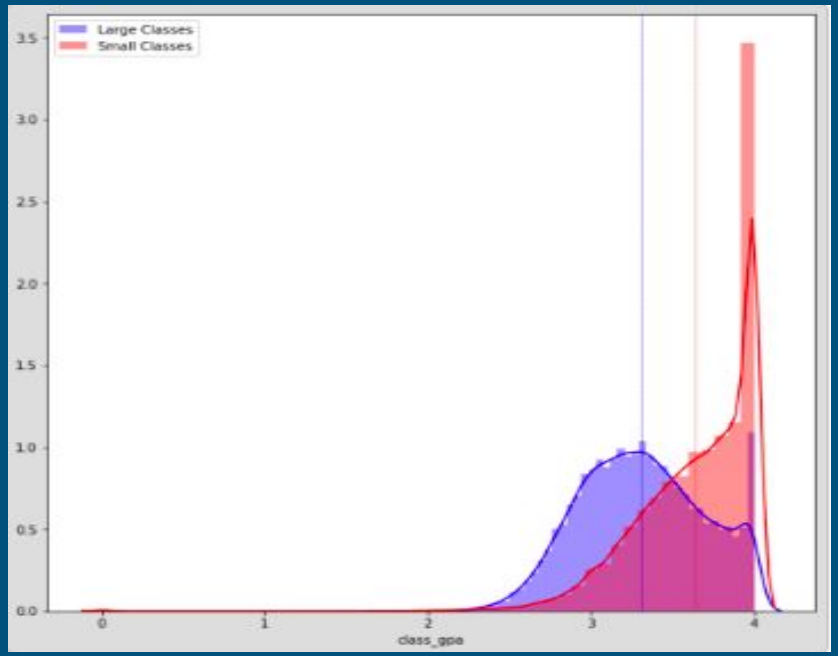
Large vs. Small Classes



- Distinct difference in grade distributions
- Small classes heavily skewed towards higher GPAs.
- Large class mean: 3.31
- Small class mean: 3.64

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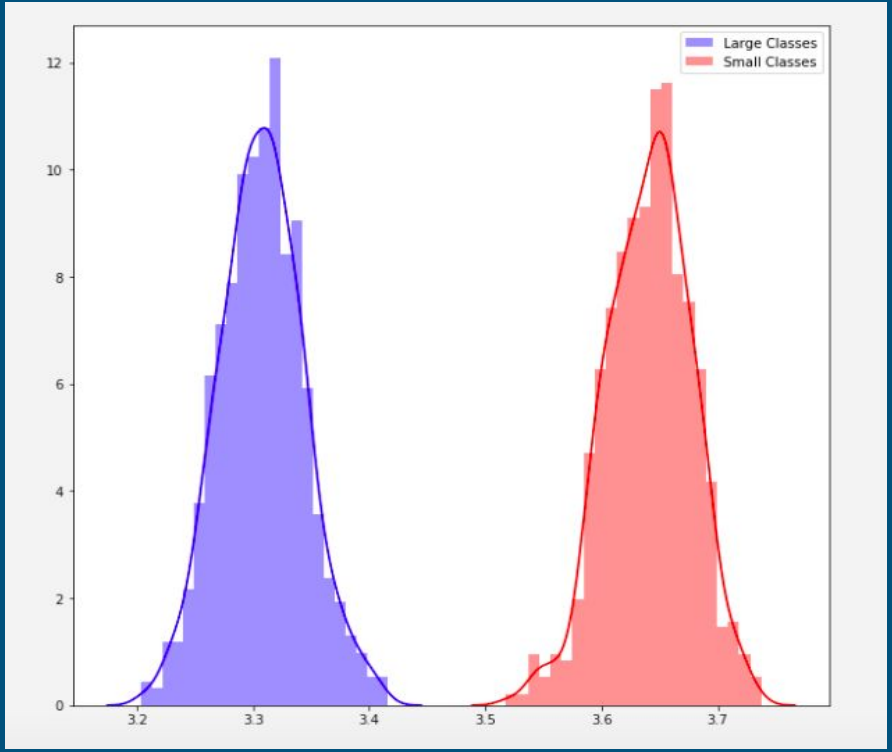
Central Limit Theorem



- Completely separate GPA means
- T- value = 0.00895
- For alpha = .05, t < t critical
- p-value ~= 0.00 (< .05)
- Reject the null hypothesis that large and small classes have the same grade distribution. It seems most likely that large and small classes have different grade distributions.

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Bias Issue of Large vs. Small Classes

Small classes are similar to small sample sizes and could introduce bias.

Instead of sample means, cumulative GPAs were compared between samples.

Cumulative GPAs: $$\frac{\sum(\text{class grade points in sample})}{\sum(\text{enrollment in sample})}$$

Result: More precise but no significant change in results

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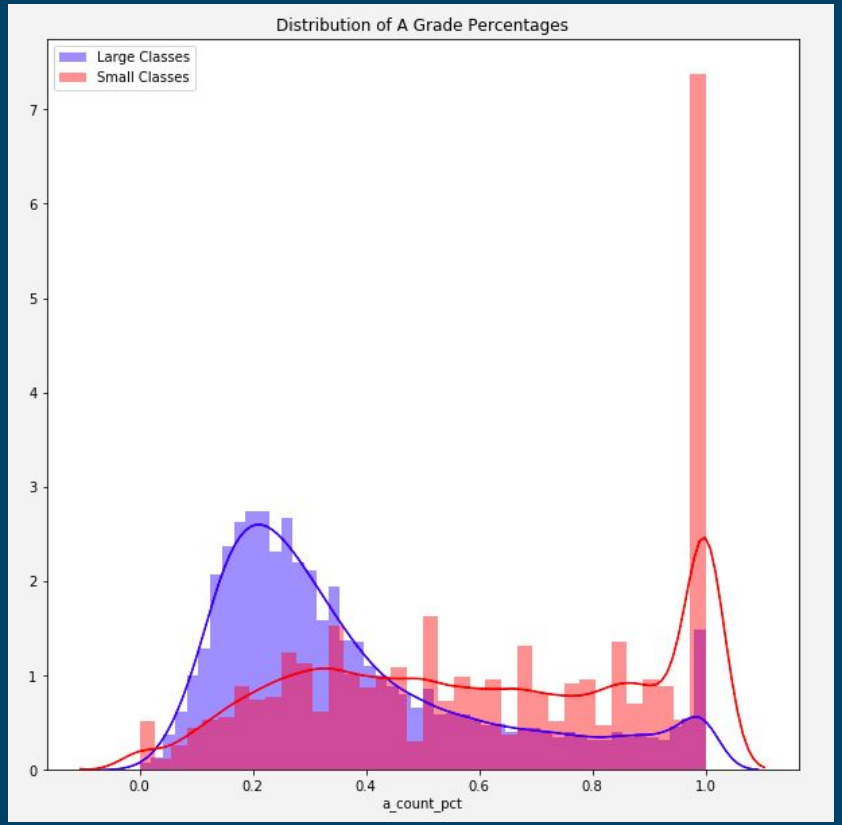
Distribution of ‘A’ Grades

In large and small classes as a percentage of class grades

Lots of ‘A’s in small classes



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Conclusions

- Changes are not necessary in STEM or liberal arts majors for retention or student success reasons.
- Consider having more smaller classes with 30 or fewer students to build student-professor relationships and address retention and graduation rates
- The issue of grade inflation needs to be examined in more depth. The data shows that the issue is right on the edge of being significant.

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Future Research Opportunities

- More years of data and could possibly help understand the issue of grade inflation. Examining correlations between individual professors and grade inflation might be helpful.
- Determine if there is a cut-off in class size (~6 students?) where distributions start to change.
- Examine whether different types of classes (introductory vs. non-introductory) have different GPAs with larger or smaller classes.
- Determine if class length (more than 60 minutes) affects GPAs.

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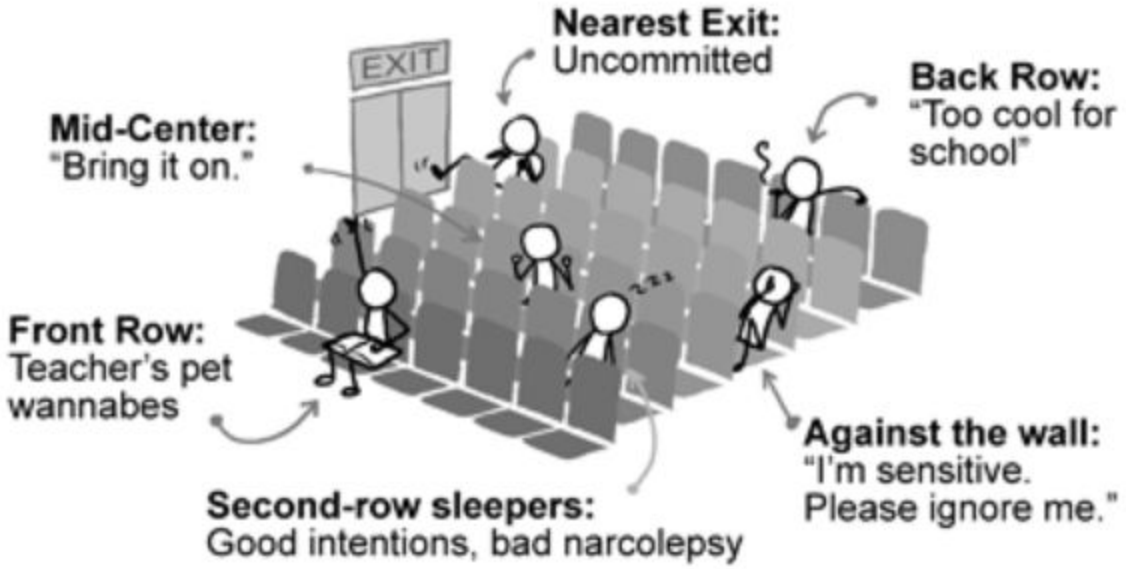
WHERE YOU SIT IN CLASS/SEMINAR

And what it says about you:



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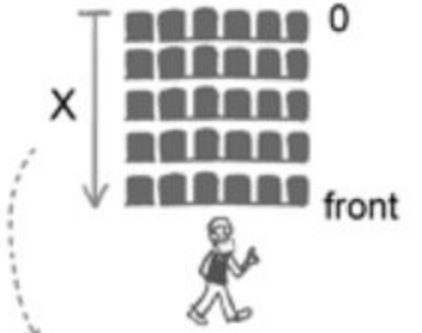
Proximity to Lecturer:



$$X = \frac{\text{How much you care}}{\text{How sleepy you are}}$$

Thank you

Questions now or in the future

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