



Grade distribution analysis of UW Madison dataset

Module 3 project
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August 23, 2019



Outline: questions to answer regarding the A grade ratio

◆ Evgeniya:

- ◆ Do instructors grade differently?
- ◆ Does class size matter?
 - ◆ Instructor grading ☐ versus size
 - ◆ Does the field of study matter: STEM vs Humanities in term of class size?

◆ Cristina:

- ◆ Does time of day matter?
- ◆ Interaction between time of day and the field of study: STEM vs Humanities?
 - ◆ Is the field of study significant in terms of time of day?



Dataset: UW Madison Courses and Grades 2006-2017

Original dataset

course_offering_uuid	
count	193262
unique	80171

instructor_name	
count	18736
unique	18598
top	SUSAN SMITH
freq	3

subject_name	
count	198
unique	198
top	WILDLIFE ECOLOGY
freq	1



Dataset: UW Madison Courses and Grades 2006-2017

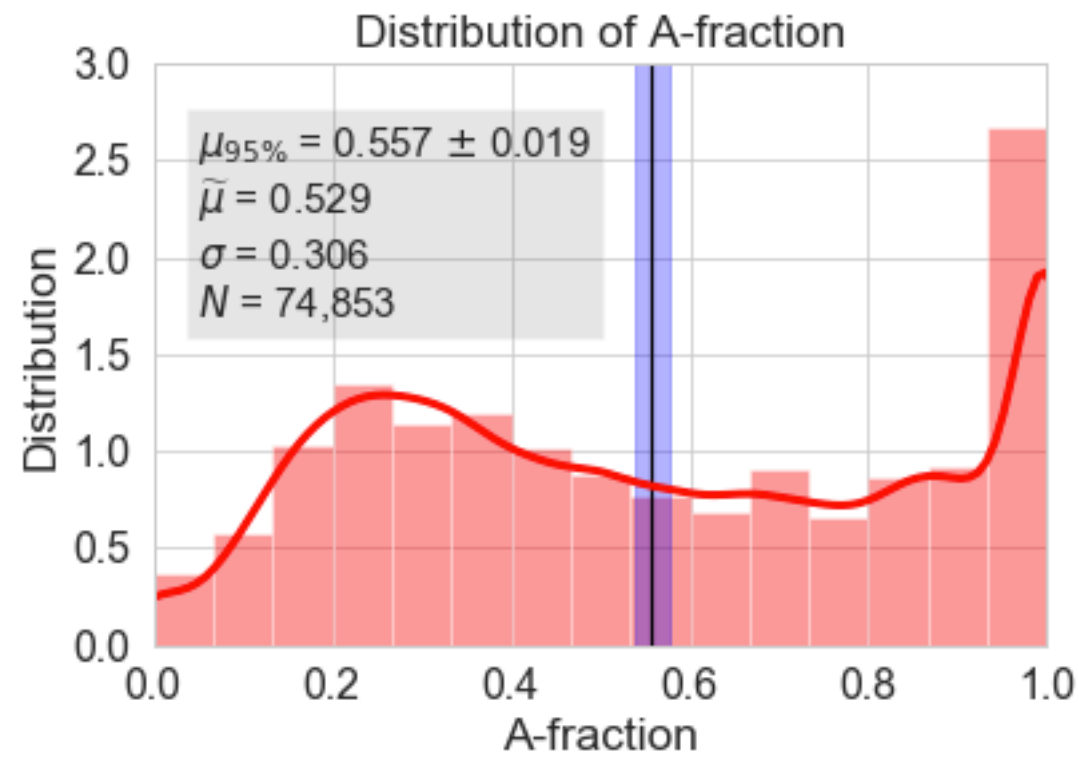
Original dataset

course_offering_uuid		instructor_name		subject_name	
count	193262	count	18736	count	198
unique	80171	unique	18598	unique	198
		top	SUSAN SMITH	top	WILDLIFE ECOLOGY
		freq	3	freq	1

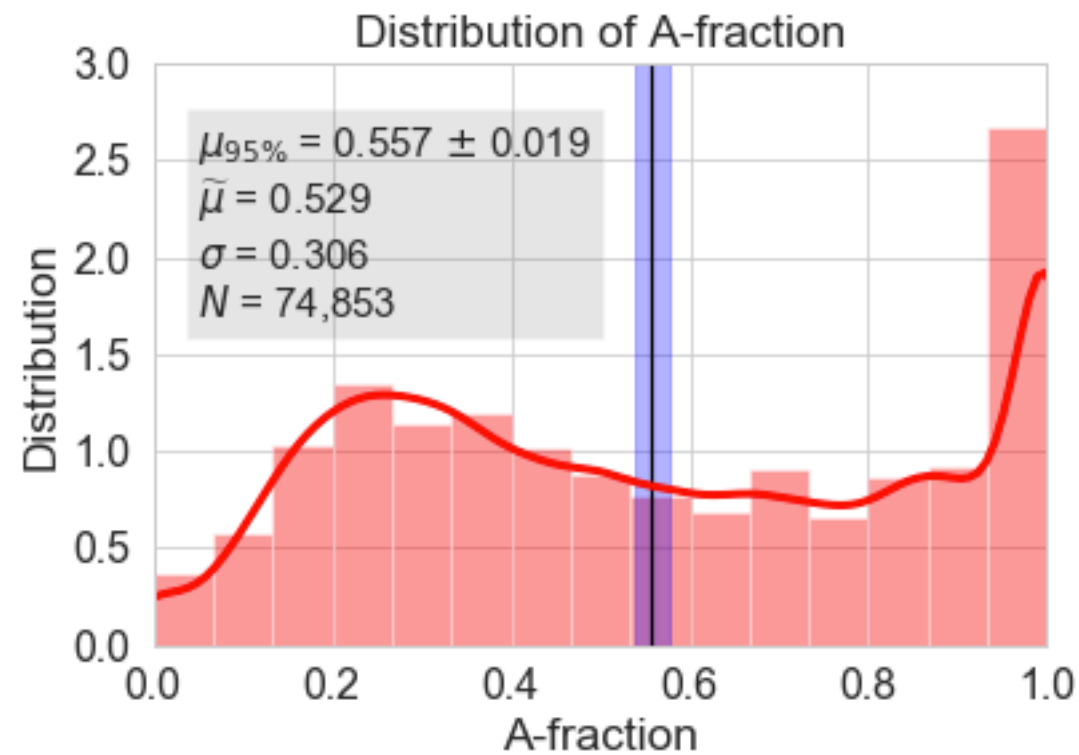
Processed dataset that includes non-missing grades, sections, instructors, subjects

	course_offering_uuid		section_uuid	instructor_name	subject_name
count	74853		74853	74853	74853
unique	47812		74853	10133	190
top	35a65d4a-702c-388e-b98b-a0127e587f16	e3742aa7-1ee5-385c-8952-32526cefd78d		MARK ALLIE	Spanish (Spanish and Portuguese)
freq	60		1	239	2738

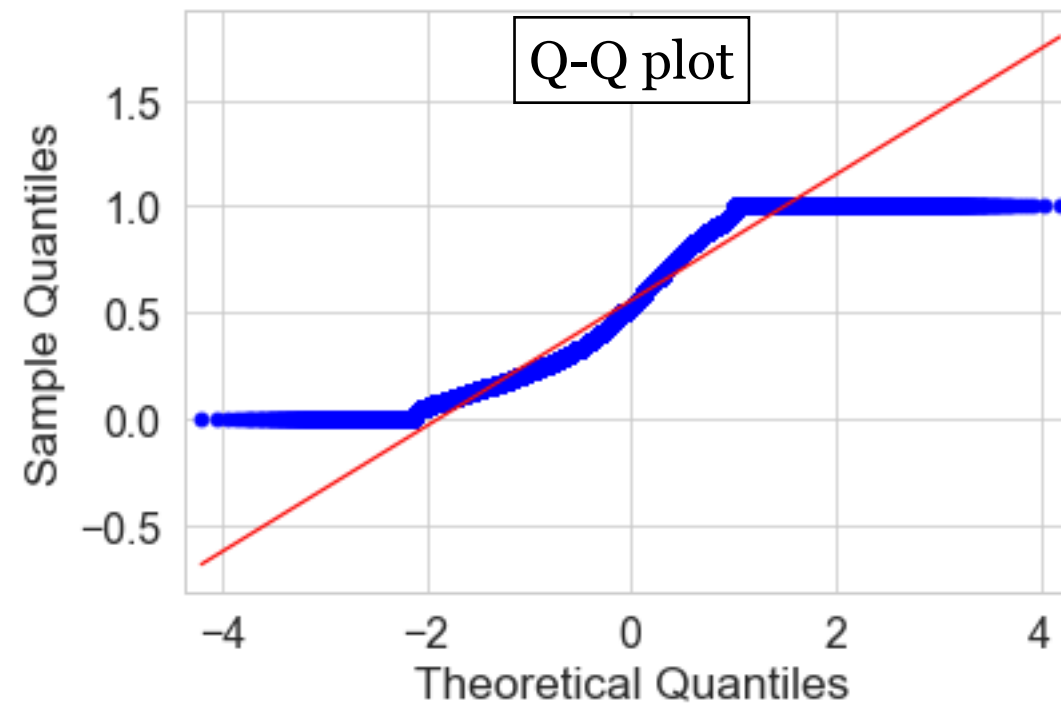
Distribution of A grade fraction



Distribution of A grade fraction



How bad is the deviation
from normal distribution?

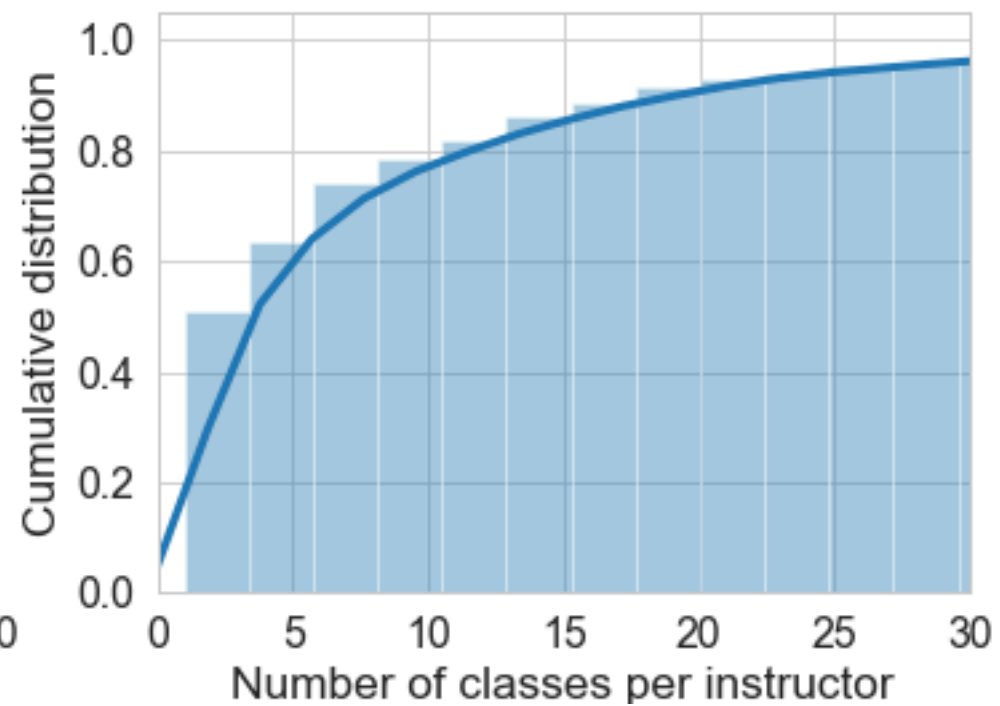
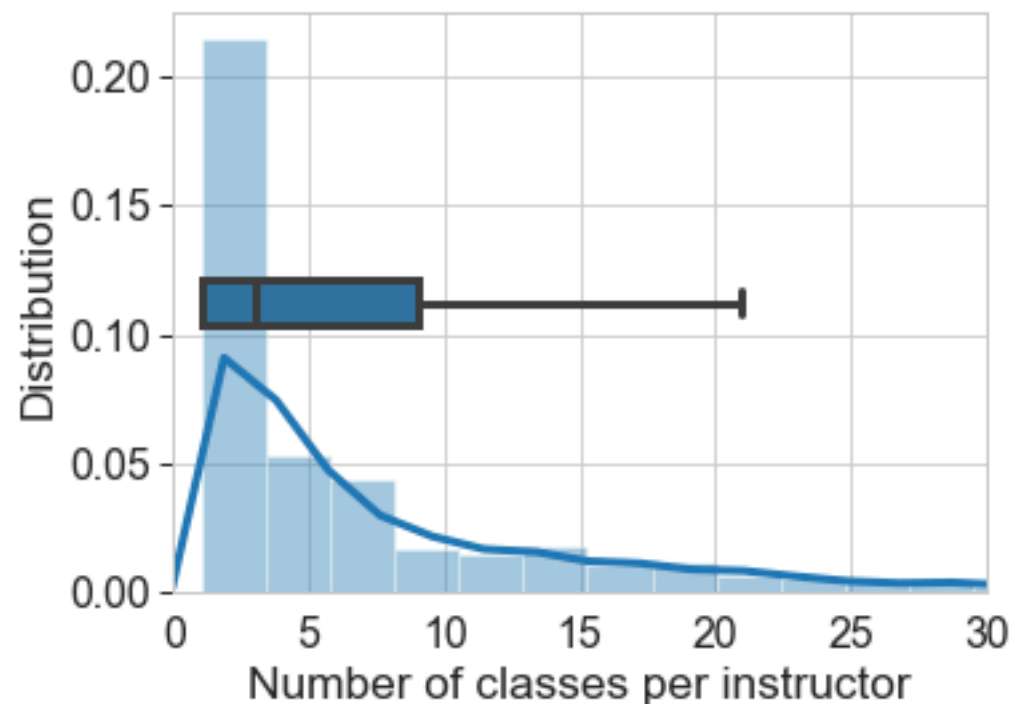


KstestResult(statistic=0.5030702257501721, pvalue=0.0)

How many classes does an instructor teach within 22 semesters?



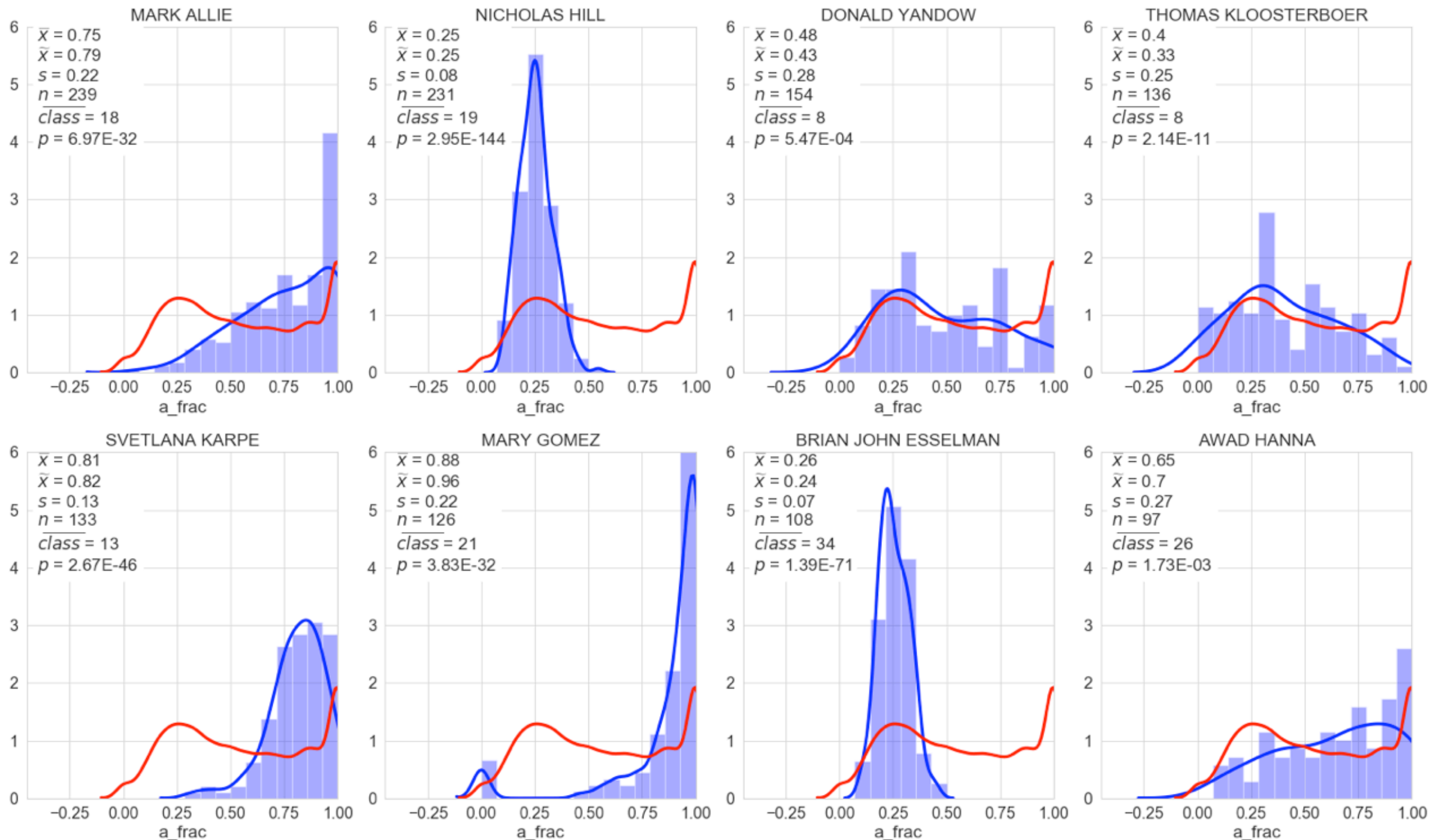
	count	mean	std	min	25%	50%	75%	max
# of classes taught by instructor	10165.0	7.363797	10.609767	1.0	1.0	3.0	9.0	239.0



Do instructors grade differently?



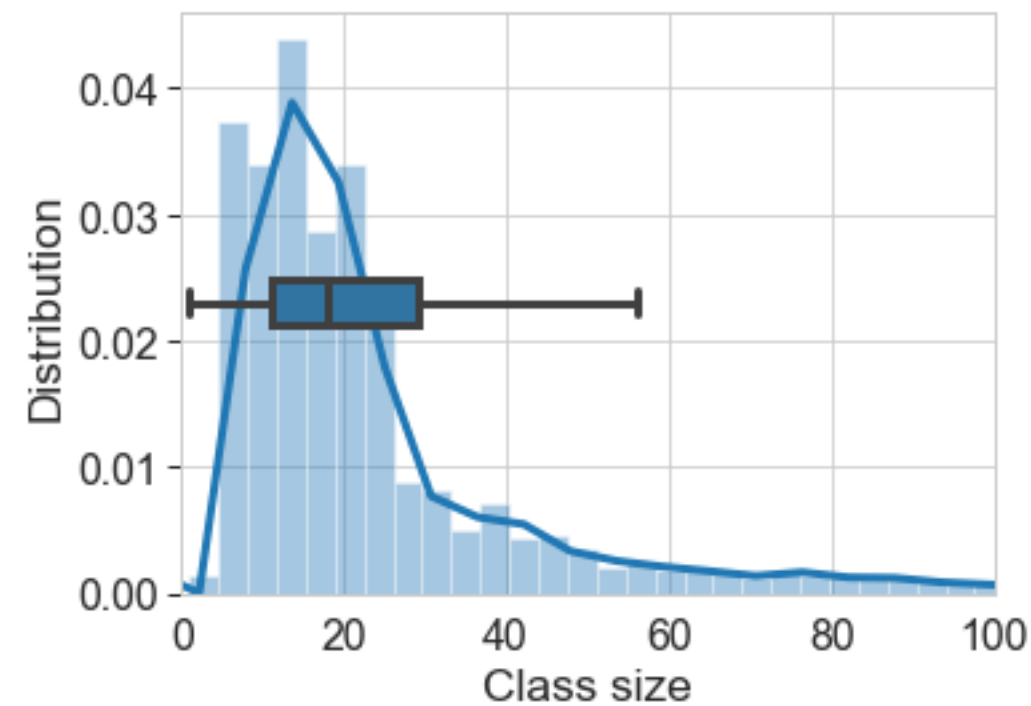
Hypothesis testing using t-statistics



What is the class size distribution?



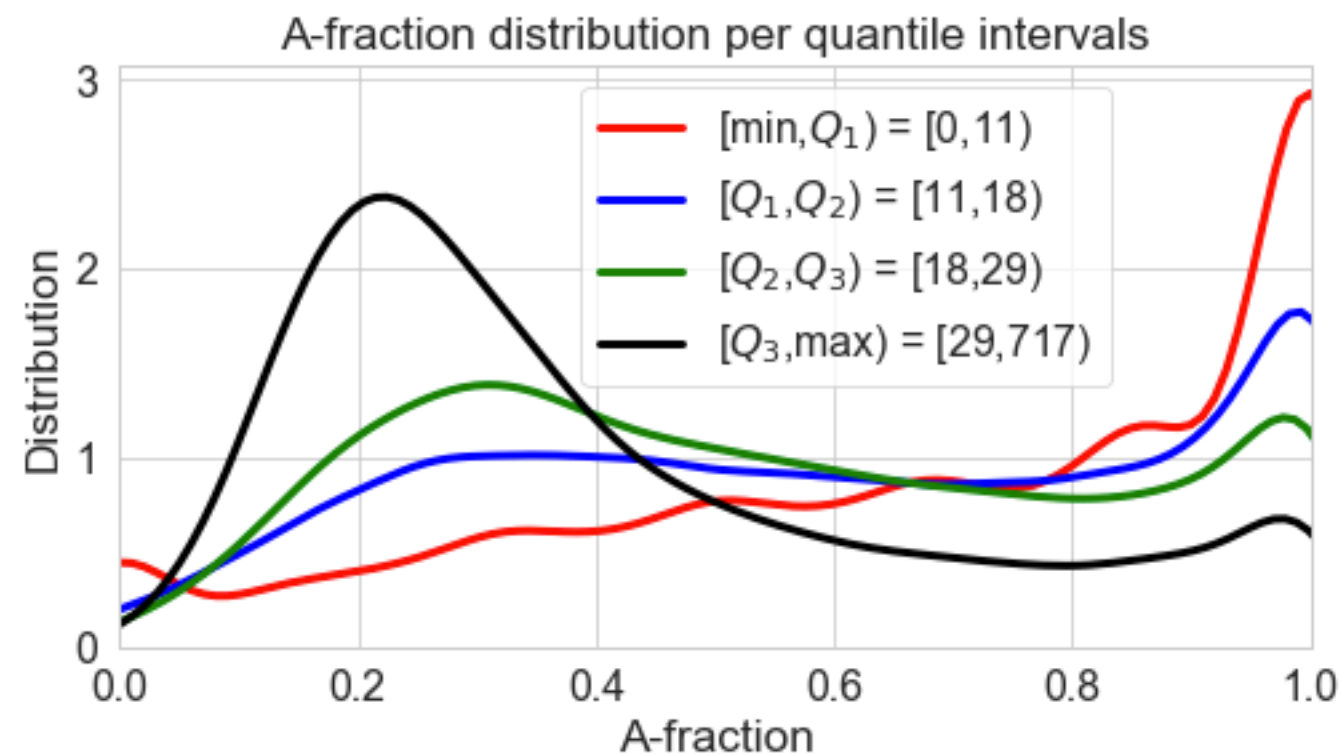
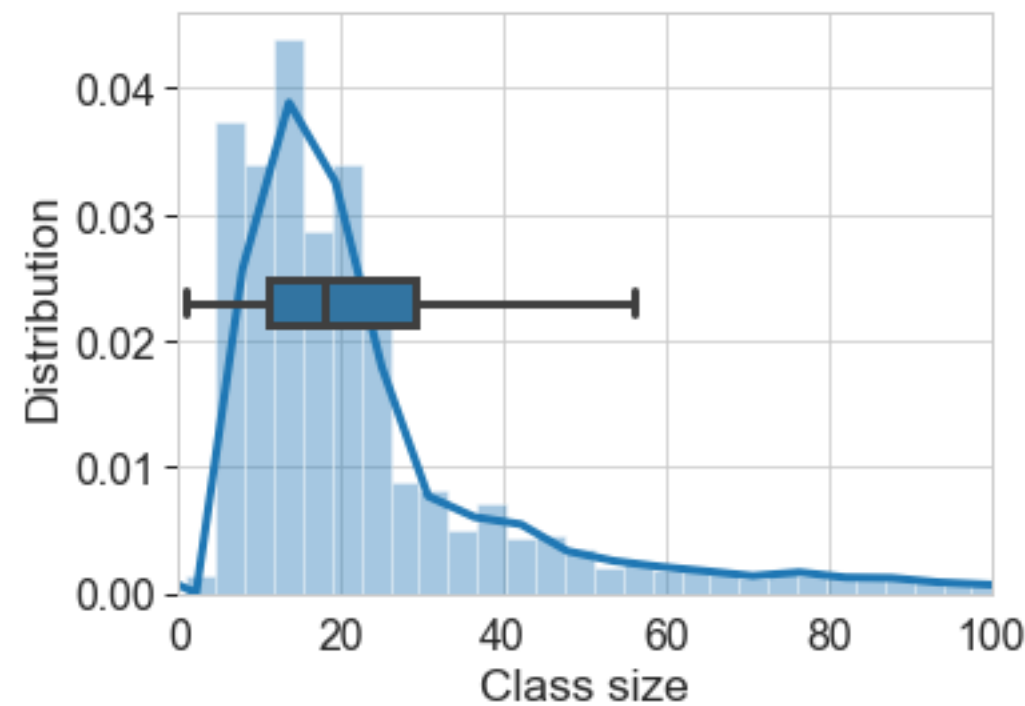
	count	mean	std	min	25%	50%	75%	max
class size	74853.0	31.582902	45.922572	1.0	11.0	18.0	29.0	717.0



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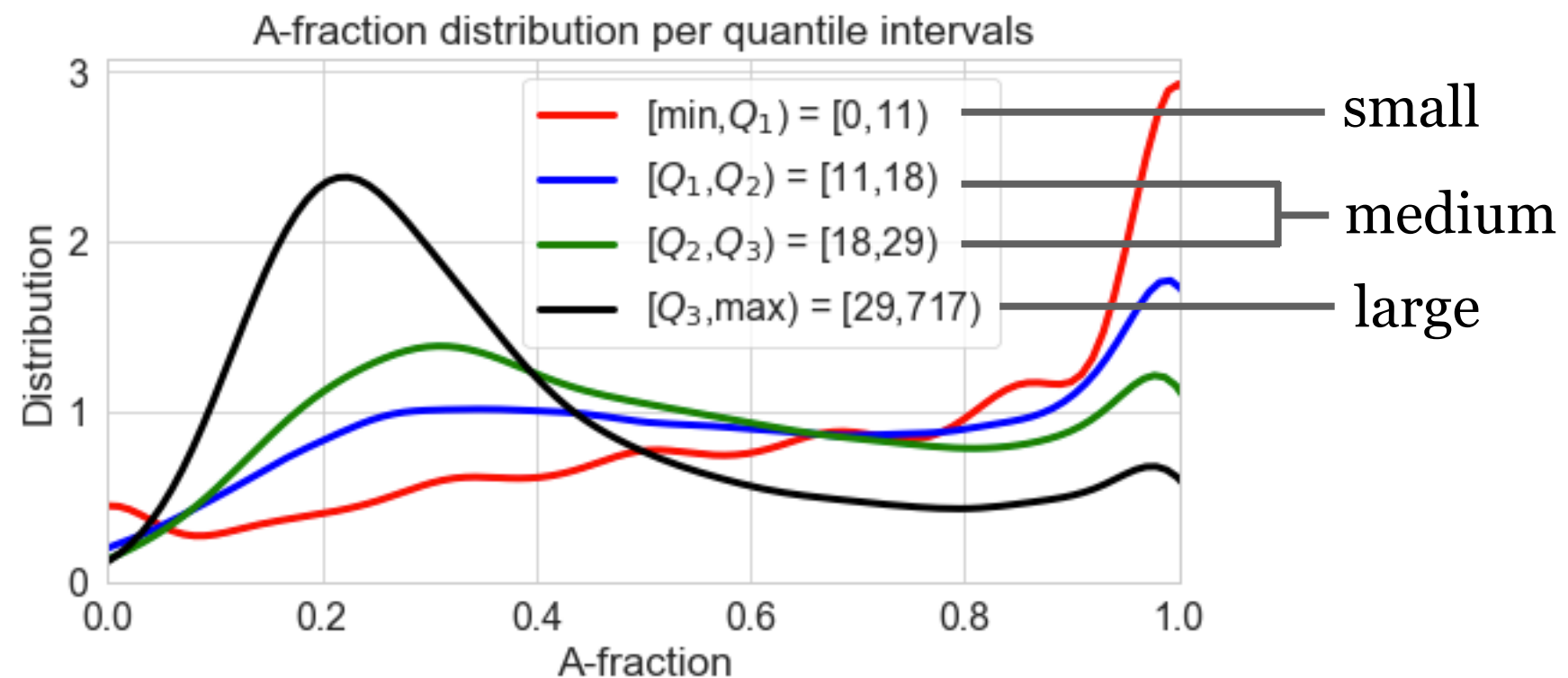
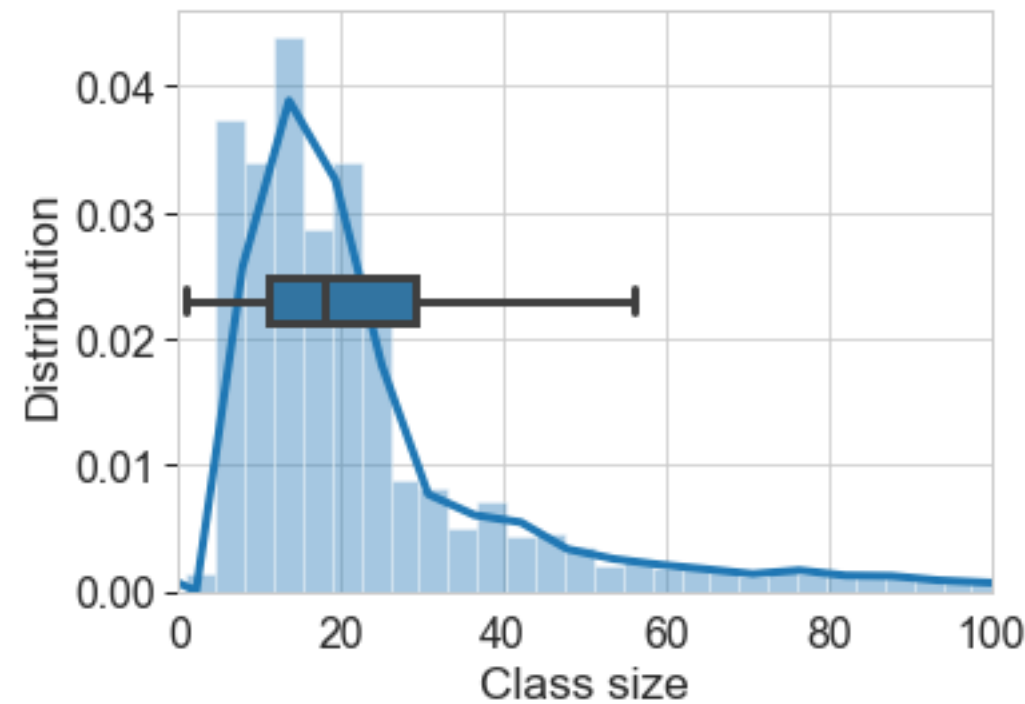
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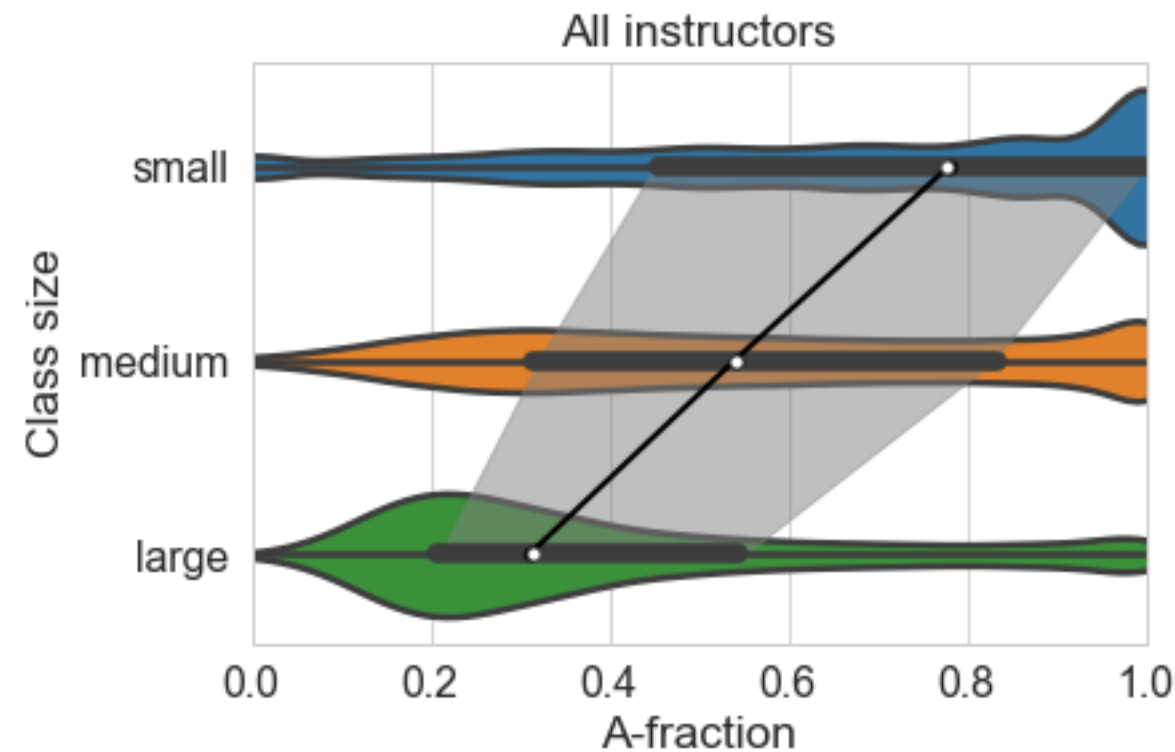
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Does class size matter?

Hypothesis testing using Kruskal-Wallis H-test



	Q1	Q2 (median)	Q3
budget			
small	0.45	0.78	1.00
medium	0.32	0.54	0.83
large	0.21	0.31	0.55

```
KruskalResult(statistic=8906.607441196318, pvalue=0.0)
```



Literature search

Houghton Mifflin Harcourt - Learning/education company

<https://www.hmhco.com/blog/class-size-matters>

Researchers have come to a general consensus that **smaller class sizes** produce **positive social, emotional, and academic results**. Findings from numerous studies, including Glass and Smith's research from 1978 and Tennessee's Project STAR conducted in the mid 1980s, conclude **smaller class sizes result in higher test scores**, produce fewer dropouts, and level the playing field for minorities and children living in poverty.

Researchers generally agree a class size of **no larger than 18 students** is required to produce the **desired benefit**.

Parents across America

<http://parentsacrossamerica.org/what-we-believe-2/why-class-size-matters/>

1. Fact: Class size is a proven and effective reform.

Studies from Tennessee, Wisconsin, and states throughout the country have demonstrated that students who are assigned to smaller classes in grades K-3rd do better in every way that can be measured: they score higher on tests, receive better grades, and exhibit improved attendance.



Analyze instructors having most uniform teaching across class sizes

instructor_name	small	medium	large	total	compare
MARK ALLIE	67	142	30	239	4.996761
JAMES SMITH	24	27	21	72	2.625000
SCOTT TEEPLE	32	17	30	79	2.614966
KELLI RICHARDS	13	38	27	78	2.192308
ANDREW WINTERSTEIN	20	35	15	70	2.142857
CATON ROBERTS	38	35	11	84	2.073413
SCOTT MELLOR	19	20	17	56	2.059949
MONICA THEIS	12	35	24	71	1.999603

$$\max \left(\frac{\text{small} \cdot \text{medium} \cdot \text{large}}{\text{total}^3} \cdot \text{total} \right)$$



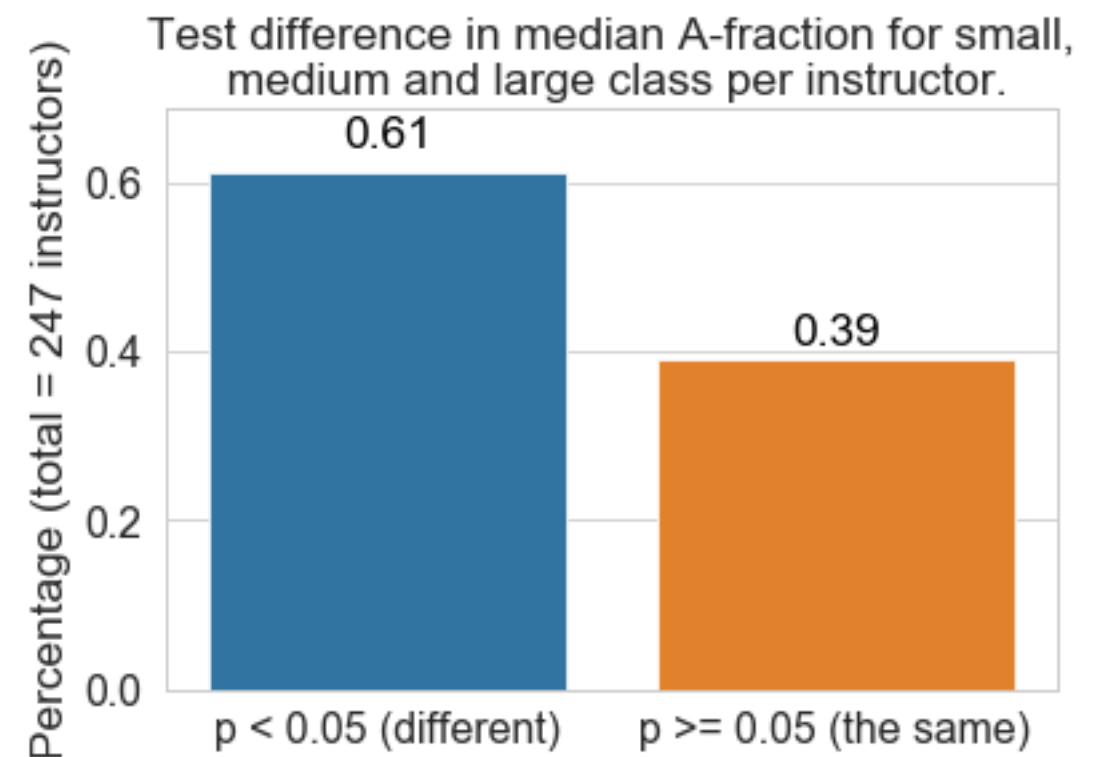


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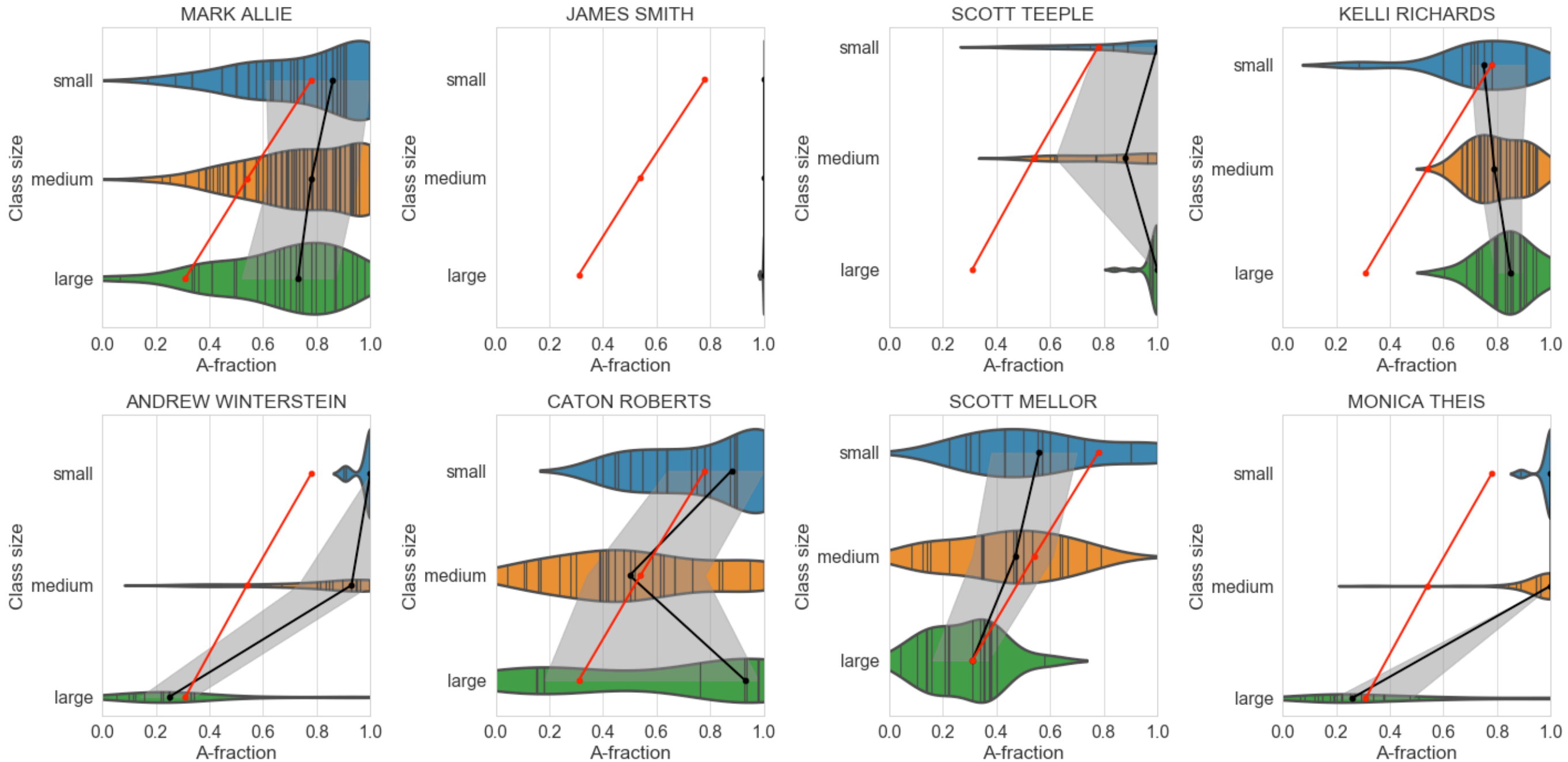
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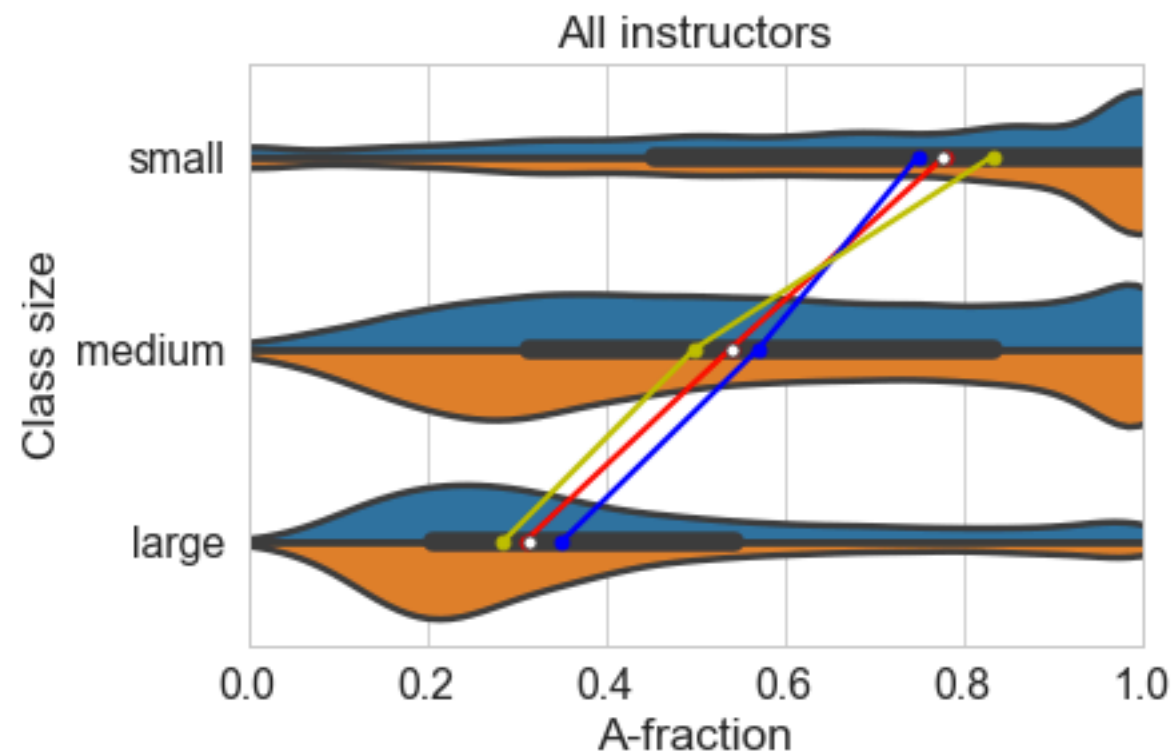
Percentage of instructors that grade differently for different class sizes, using the Kruskal-Wallis H Test:



Instructors have different grading styles



Field of study (STEM vs humanity) influence



Kruskal-Wallis H Test:

The **difference** between median within class size is **significant** between **STEM** and **Humanity** fields

Thank you! Questions?

GRADE INFLATION

A

AVERAGE

B

BELOW
AVERAGE

C

COMPLAIN
UNTIL YOU GET
A BETTER
GRADE

D

THE DEAN
GETS
INVOLVED

F

FILE
LAWSUIT

I

IN COMPLETE
DENIAL

Future work

Quantify the influence of different factors:

- class size (major factor)
- field
- instructor