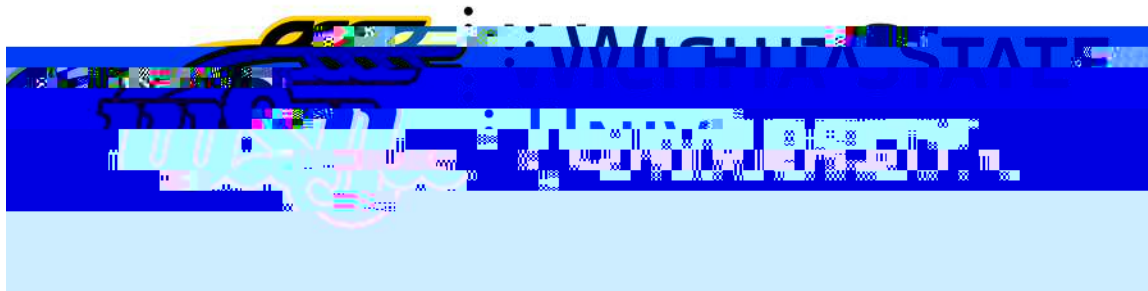


Effect of Plus-Minus Grades on Graduation with Academic Distinction for Engineering Students at Wichita State University



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Cohen Honors College

Presentation Outline

Background on grade inflation and plus-minus grading

Methodology used in this study

University-wide results of graduation with distinction

Grade distribution for courses university-wide under whole-letter grade system

Grade distribution for engineering courses under whole-letter and plus-minus grading systems

Results of graduation with distinction by discipline

Summary & future work

Background on Grade Inflation

Stuart Rojstaczer (www.gradeinflation.com) has collected grade inflation trend over the last 50 years

- o Dataset includes 170 schools

Grade of C was most common grade until the Vietnam war (draft deferment effect thereafter)

Grade of A is now the most common grade

Background on Trend toward Adopting Plus-minus Grading System

Whole-letter grade (A, B, C, D, F) system was prevalent before grade inflation began

Many universities since the 1990s have implemented plus-minus (+/-) grading system (with A, A-, B+, etc.)

- o Number of schools using +/- grading system*: 36% in 1992, 56% in 2002, and 63% in 2014

Key motivator: a belief that +/- system will reverse grade inflation and student performance will be better differentiated**

Publicly available grade information is not easily accessible, but grade inflation is also present at Wichita State Univ (WSU)***

- o Registrar stated in 2004 that A is most prevalent grade

References: *AACRAO (Registrars Assoc); **Morgan *et al*, 2007; ***WSU registrar, 2004

Background on Effect of Plus-minus Grades on GPA / Motivation

Reports in literature about the effect of +/- grading on GPA are somewhat mixed

- o Many report no difference in mean overall GPA
- o Hypothesized explanation: grades with pluses probably cancel minuses over the course of a student's academic career

Most reports recognize that there would be a small deflationary effect on students in the top A grade bracket

This leads to a two-fold motivation for the present study:

- 1) How does +/- grading affect the top A-level students?
- 2) Are there differences by discipline, from effect of +/- grading?

Further Background & Methodology

Plus-minus grading implemented at WSU since the fall of 2009

Graduation with honors has remained the same under +/- grading

- o Summa Cum Laude (SCL) honors require a GPA of 3.90
- o Magna Cum Laude (MCL) honors require a GPA of 3.55
- o Cum Laude (CL) honors require a GPA of 3.25

Although wide in GPA range, the number of honors graduates in each category is a proxy for distribution of student GPAs

- o Publicly available commencement brochures were used to determine the number of graduates in each honors category
- o Five year periods before +/- grades (fall 2002 to spring 07) and after +/- grades (spring 2014 to fall 18) were considered

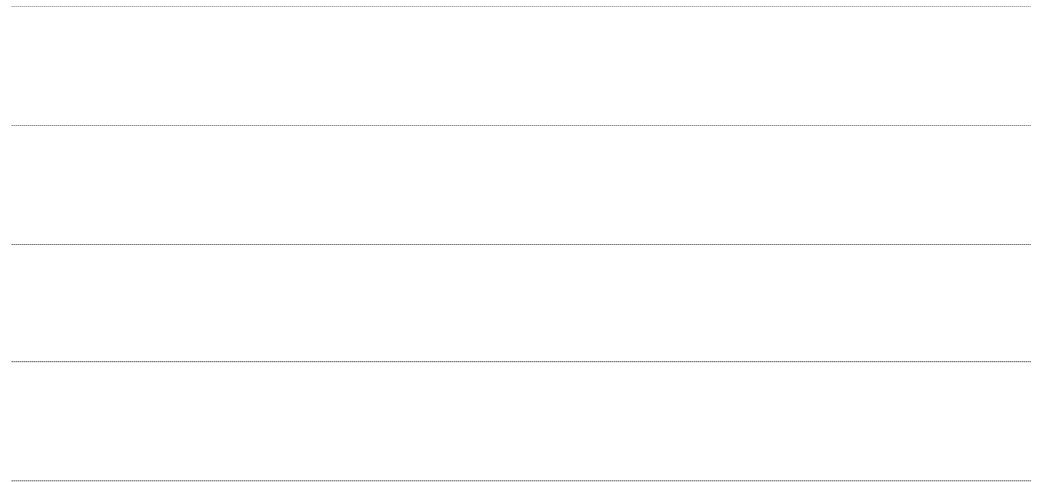
Grade Distribution in Classes with Whole-letter Grades

Distribution of grades for individual classes at WSU (fall 2003)

- o Lower Division with 2.78 GPA
- o Upper Division with 3.12 GPA
- o Average of two (® 2.95 GPA)

National average*

WSU ave is similar to National ave



Grade Distribution in Classes with Whole-letter Grades

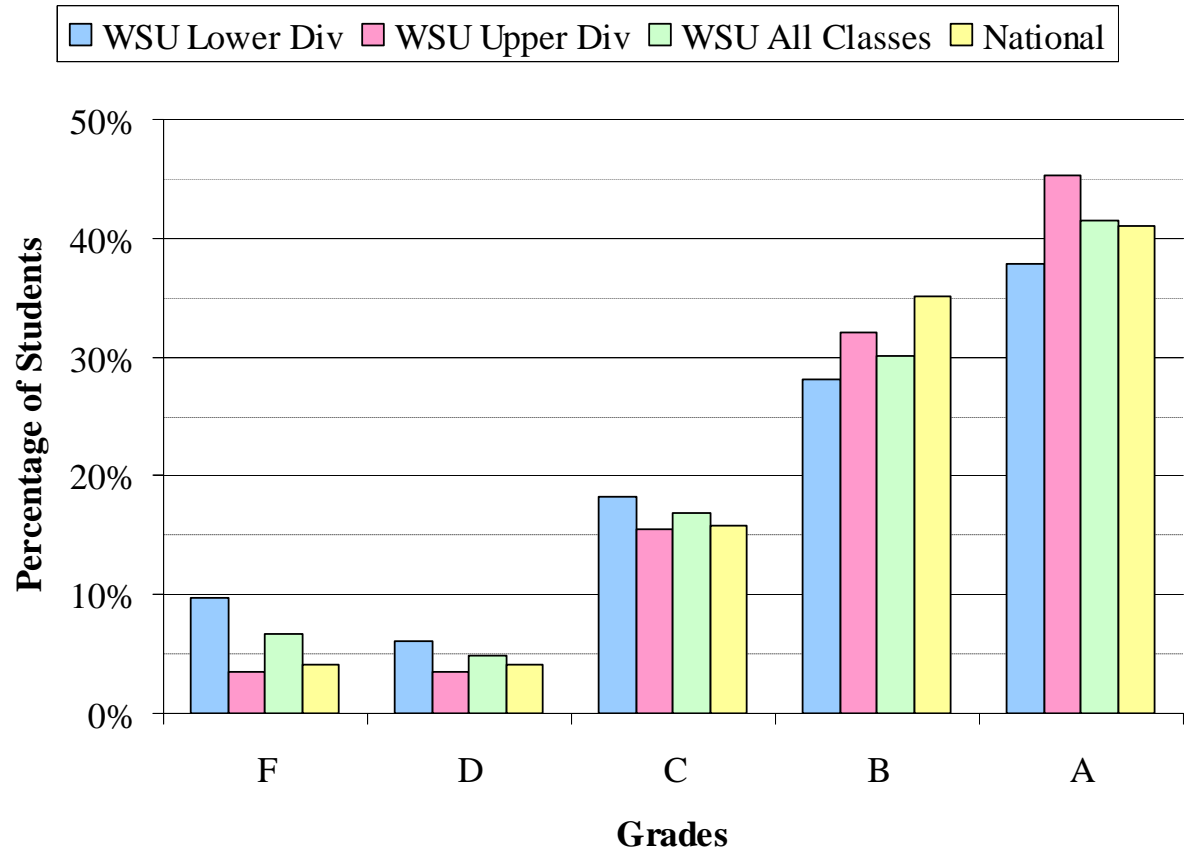
Higher GPA with more A's & B's for upper div than for lower div

Distribution is not symmetric "Bell" shaped (Gaussian)

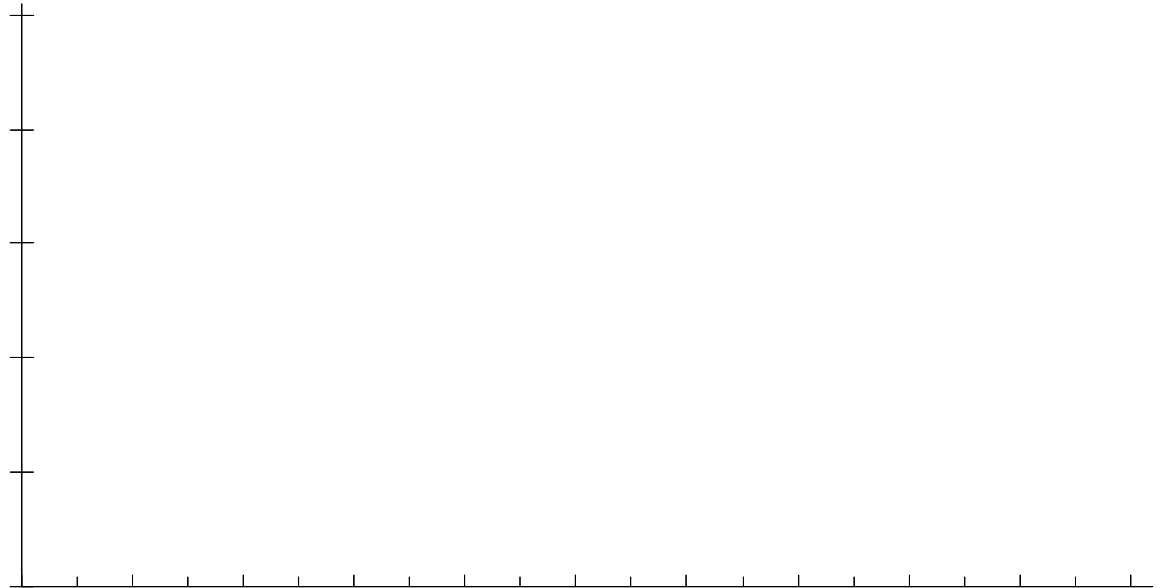
- o Mean shifted right
- o Left tail does not diminish – number of F's > D's

Distribution with +/- grades not available

® look at **actual** distribution for 1st author's classes



Score Distribution of 1st Author's Aerospace Engineering Courses



17 September 2019

Discussion of Score & GPA for Engineering Courses by 1st Author

Statistics for courses under **whole-letter grades** (2002-09)

Category	# Students	# per class	Ave Score & S.D.	GPA
Sophomore Year	471	36	79 ± 17	2.51
Junior Year	529	44	80 ± 13	2.85
Overall Average	1000	40	80 ± 14	2.70

Statistics for courses under **+/- grading** (2009-14)

				GPA
Sophomore Year	471	47	76 ± 15	2.23
Junior Year	549	61	81 ± 11	2.68
Overall Average	1020	54	79 ± 13	2.48

Discussion of Score & GPA for Engineering Courses by 1st Author

Lower level class GPA < upper level class GPA

Category	# Students	# per class	Ave Score & S.D.	GPA
Sophomore Year	471	36	79 ± 17	2.51
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Overall Average	1000	40	80 ± 14	2.70

for both **whole-letter grade** and **+/- grade**, respectively

Category	# Students	# per class	Ave Score & S.D.	GPA
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Discussion of Score & GPA for Engineering Courses by 1st Author

Standard deviation narrows for +/- grades – possible cause?

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Discussion of Score & GPA for Engineering Courses by 1st Author

Could change to +/- grades cause this difference?

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Convert to whole-letter grades & re-calculate GPAs ® no change

Category	# Students	# per class	Ave Score & S.D.	GPA
Sophomore Year	471	47	76 ± 15 2.22	↔ 2.23
Junior Year	549	61	81 ± 11 2.69	↔ 2.68
Overall Average	1020	54	79 ± 13 2.48	↔ 2.48

Discussion of Score & GPA for Engineering Courses by 1st Author

Recent (+/- grade) class size larger ® likely cause of GPA -

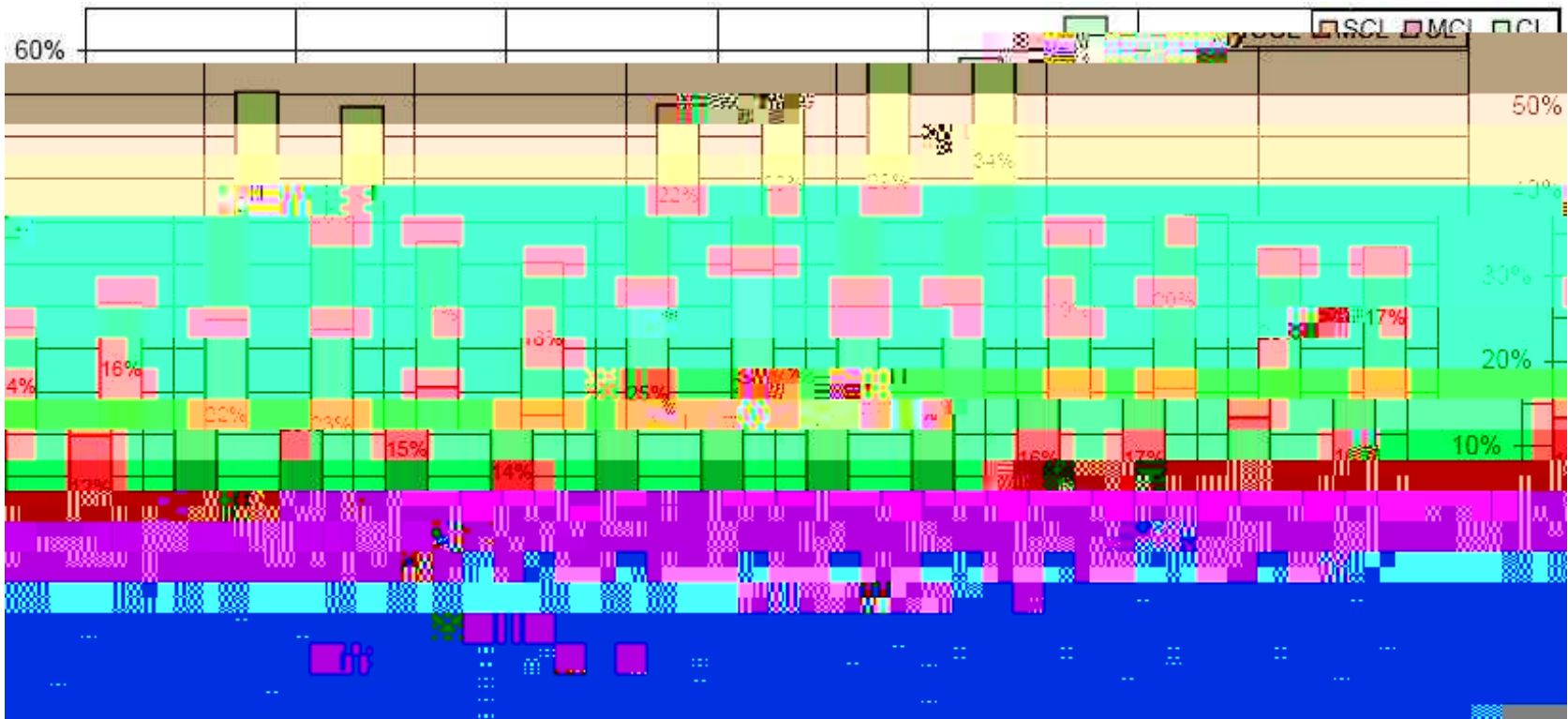
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o Topic for future paper

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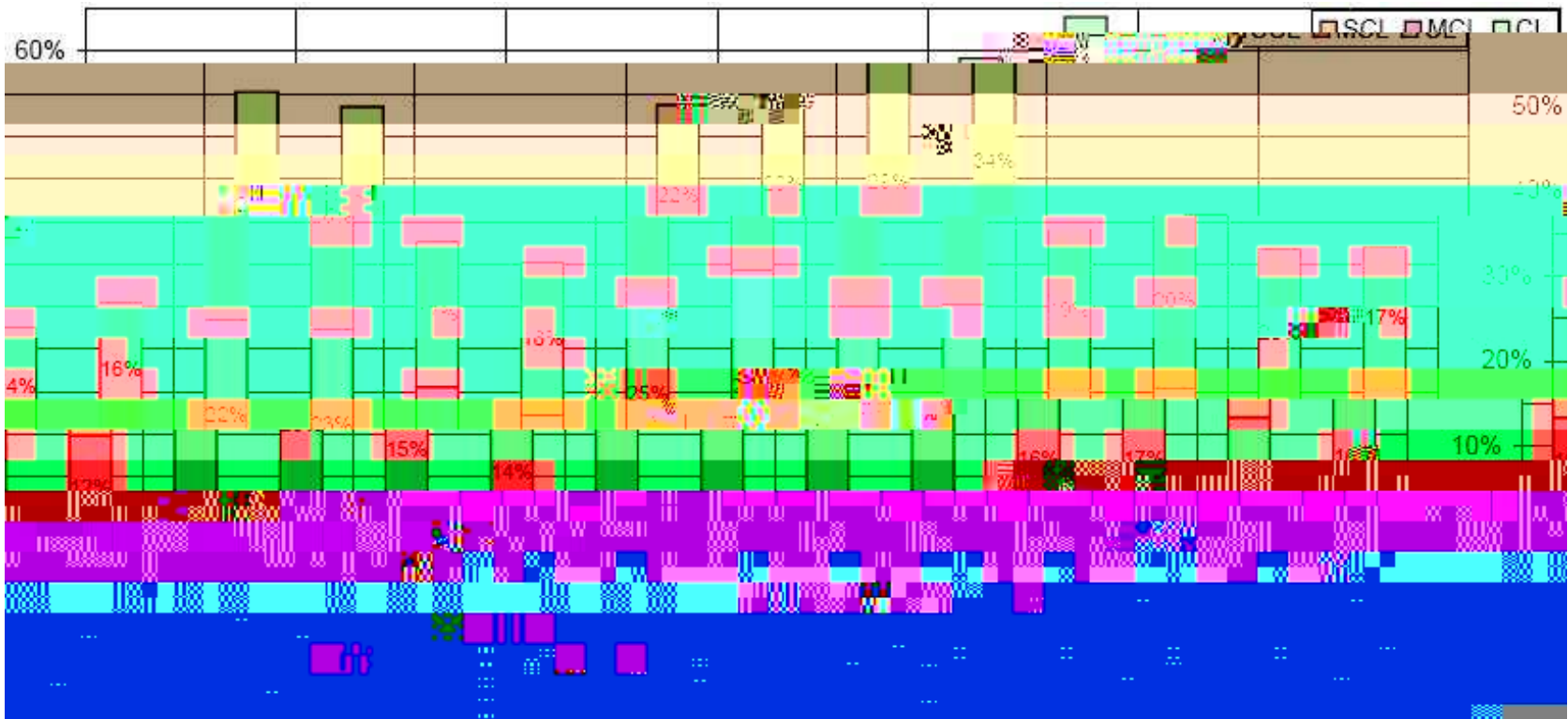
Results of Graduation with Academic Distinction by Discipline

Results by discipline: whole-letter grade on left & +/- grade on right
 SCL = orange (bottom), MCL = pink (middle), CL = green (top)



Results of Graduation with Academic Distinction by Discipline

Comparing across disciplines is not meaningful because of differing requirements



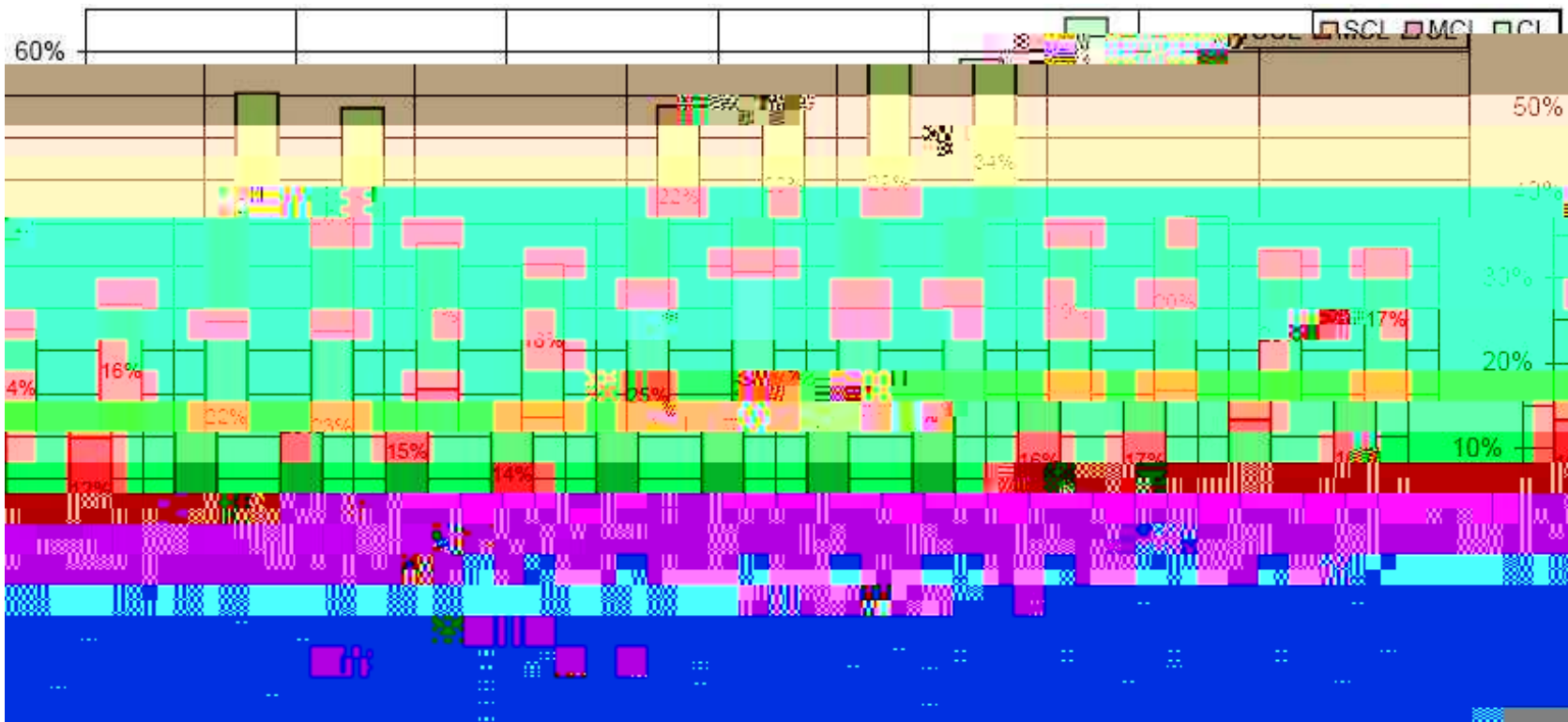
Results of Graduation with Academic Distinction by Discipline

- o Example 1: Education & Health Professions requires $GPA \geq 2.5$
- o Example 2: Fine Arts requires passing sophomore review



Results of Graduation with Academic Distinction by Discipline

Most disciplines increased number of graduates with distinction
 Finer details & observations easier to see from tabular results



Change in Number of Graduates with Academic Distinction by Discipline

Table gives amount of change: those under whole-letter grade minus those in 1970-1979/1980-1989-

Change in Number of Graduates with Academic Distinction by Discipline

Number of SCL decreased for almost every discipline

- o Only exception is **Liberal Arts B.S.**

Discipline	SCL	MCL	CL	SCL+MCL+CL
Business	-0.7%	+2.2%	+1.4%	+2.9%
Education (now Applied Studies)	-1.5%	+0.3%	-0.6%	-1.8%
Engineering	-2.1%	-1.2%	+0.8%	-2.9%
Fine Arts	-0.4%	+2.5%	-1.2%	+0.9%
Health Professions	-0.6%	+0.9%	+4.6%	+4.9%
Liberal Arts B.A.	-0.6%	+0.9%	+1.4%	+1.7%
Liberal Arts B.S.	+0.8%	+2.4%	-3.0%	+0.2%
Entire University	-0.5%	+2.1%	+2.1%	+3.5%

Change in Number of Graduates with Academic Distinction by Discipline

Discipline	SCL	MCL	CL	SCL+MCL+CL
Business	-0.7%	+2.2%	+1.4%	+2.9%
Education (now Applied Studies)	-1.5%	+0.3%	-0.6%	-1.8%
Engineering	-2.1%	-1.2%	+0.8%	-2.9%
Fine Arts	-0.4%	+2.5%	-1.2%	+0.9%
Health Professions	-0.6%	+0.9%	+4.6%	+4.9%
Liberal Arts B.A.	-0.6%	+0.9%	+1.4%	+1.7%
Liberal Arts B.S.	+0.8%	+2.4%	-3.0%	+0.2%
Entire University	-0.5%	+2.1%	+2.1%	+3.5%

Change in Number of Graduates with Academic Distinction by Discipline

Discipline	SCL	MCL	CL	SCL+MCL+CL
Business	-0.7%	+2.2%	+1.4%	+2.9%
Education (now Applied Studies)	-1.5%	+0.3%	-0.6%	-1.8%
Engineering	-2.1%	-1.2%	+0.8%	-2.9%
Fine Arts	-0.4%	+2.5%	-1.2%	+0.9%

Summary

Effect of +/- grading system on graduation with academic distinction was considered

- o Data sets consisted of five-year periods when whole-letter grades were used and for a similar period under +/- grading

Overall, the number of *summa cum laudes* decreased with +/- grading while the number of graduates in other distinction categories increased

In engineering, there was a decrease in *summa* and *magna cum laudes* without a corresponding increase in *cum laudes*

Actual grade distributions in Engineering classes were also considered

- o Increased class size appeared to affect student performance
- o This is a topic for future study