From: Larry Smolinsky, Chair
Department of Mathematics

Re: Calculus I (Math 1550).

The Department of Mathematics wishes to discuss a proposal for changing prerequisites of Math 1550, Analytic Geometry and Calculus I. This course is often considered a gateway into Science, Technology, Engineering, and Mathematics (STEM) majors; hence it is a matter that needs the attention and understanding of faculty and administrators in these fields.

The proposal is to make a courseless prerequisite to Math 1550, following a model explored at University of Illinois Urbana-Champaign (UIUC) and now in use at University of Texas-Austin (UT). The change to a courseless prerequisite will require a catalog change.

LSU DWF rates are (to the best of my knowledge) consistent with national rates in the mid 30's. However, the DFW rate can be lowered and certain groups of students are in need of attention. (See page 3 for Budget and Planning data from 2008-2009.) The indication—and actually the hope—is that some of these groups are growing.

At the base of the system is an artificial intelligence system for individual assessment and study (remediation) known by the near acronym ALEKS, for Assessment and LEarning in Knowledge Spaces. ALEKS has both an assessment mode (which is referred to as the placement exam below) and a learning mode. ALEKS is not a system to teach calculus. The highest level it addresses is precalculus.

An example of a courseless prerequisite is from UT's calculus course. The course description now in effect reads:

M 408N Differential Calculus for Science
Introduction to the theory of differential calculus of one variable, and their applications to the natural sciences. Topics include limits and differentiation, with applications to rates of change, extremes, graphing, and exponential growth and decay. Prerequisite: An adequate score on the ALEKS placement exam.

University of Illinois lists both a course and an ALEKS score, but the ALEKS score is required.

MATH 220 Calculus
First course in calculus and analytic geometry; basic techniques of differentiation and integration with applications including curve sketching; antidifferentation, the Riemann integral, fundamental theorem, exponential and trigonometric functions. Credit is not given for both MATH 220 and either MATH 221 or MATH 234. Prerequisite: MATH 016 or MATH 115; and an adequate ALEKS placement score.

The ALEKS score is required to be fresh, which means less than approximately 4-6 months old. Students must meet the prerequisite regardless of whether they are continuing students, entering freshman, or transfer students. A student who wishes to take calculus signs up to take the ALEKS assessment, preferably some months in advance of the course. If the student's score is inadequate, then they are put into learning mode in ALEKS to work on raising their score. They continue until they meet the requirements. If they do not have the required score a week into classes, then they do not meet the prerequisites and cannot take the course.

- The hurdle is not too high for students, since the material is precalculus and really is necessary to learn and understand calculus. All students will have had the material in previous coursework.
- ALEKS will remediate below precalculus for those students who need it. It is likely that a large number of students advance past college taught classes focused on college algebra and trigonometry and need further remediation.
- Students are less resistant to ALEKS than to taking a whole course since ALEKS just addresses the particular student's gaps in knowledge and skills.
- ALEKS scores correlate well with success in calculus while ACT scores do not, e.g., see attached data.

UIUC and UT both use ALEKS for overall placement and prerequisites for mathematics classes. We are not yet proposing overall placement, but it may be a natural step. A step the mathematics department and university administration may consider.

On pages 4-9 are plots supplied by Michael Raney, Assistant Dean in the College of Natural Sciences at UT. There is included a comparison of results from UIUC of ALEKS and ACT scores for Calculus I, which will be addressed more fully by Alison Ahlgren in her talk. In UT's standard calculus course Math 408C, Calculus I: Differential and Integral Calculus, Dr. Raney reports that (1) the enrollment was constant from 2008 to 2009 and (2) the DFQ rates (Q is our W) are shown in Table 3.

Table 3

Fall 2008 (without ALEKS)	31%
Fall 2009 (with ALEKS)	24%

The plots are of correlations of ALEKS scores or ACT scores with final grades. ALEKS and ACT scores grouped into buckets of width 5 and the grades of students in each bucket are averaged.

MATH 1550 Students
First Time Math 1550 Grade Distribution

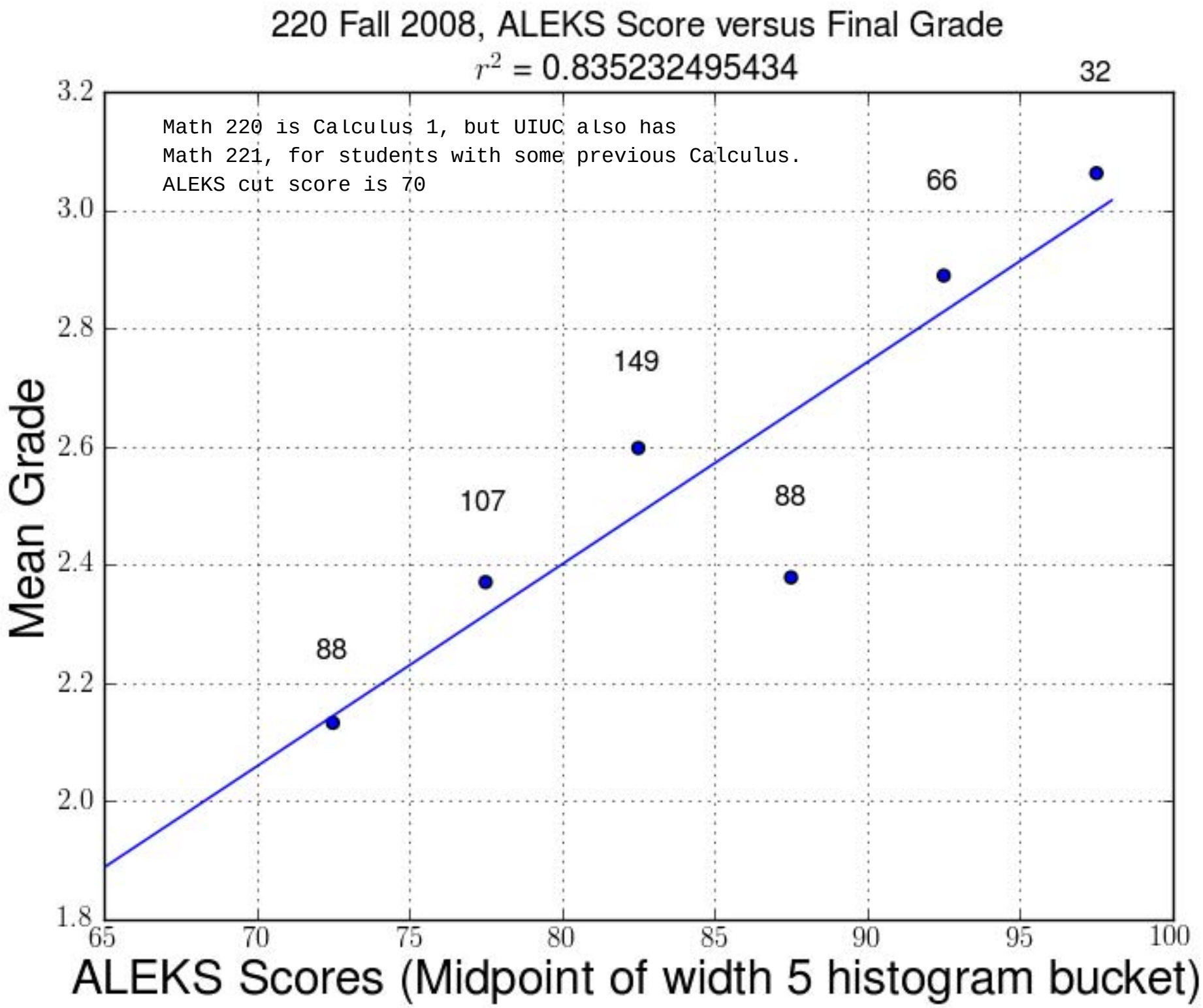
	Fall 2008 and Spring 2009																	
	A		AU		B		C		D		F		P		W		Total		
		%		%		%		%		%		%		%		%		%	Success
1 Freshmen Math 1550 Fall 2008	209	30.3			193	28.0	134	19.4	49	7.1	34	4.9			70	10.2	689	100.0	77.8
2 Freshmen Math 1023 / math 1550	31	22.3			35	25.2	34	24.5	14	10.1	9	6.5			16	11.5	139	100.0	71.9
3 Freshmen Math 1022 / math 1550	77	23.8			95	29.4	70	21.7	30	9.3	23	7.1			28	8.7	323	100.0	74.9
4 math 1550 with graded LSU 1021 & 1022	7	5.0			23	16.3	39	27.7	22	15.6	21	14.9			29	20.6	141	100.0	48.9
5 math 1550 with no LSU 1021/1022	14	15.6	2	2.2	17	18.9	14	15.6	10	11.1	9	10.0			24	26.7	90	100.0	50.0
6 math 1550 with other	75	20.8			77	21.4	63	17.5	32	8.9	36	10.0	1	0.3	76	21.1	360	100.0	59.7
Total	413	23.7	2	0.1	440	25.3	354	20.3	157	9.0	132	7.6	1	0.1	243	13.9	1,742	100.0	69.3

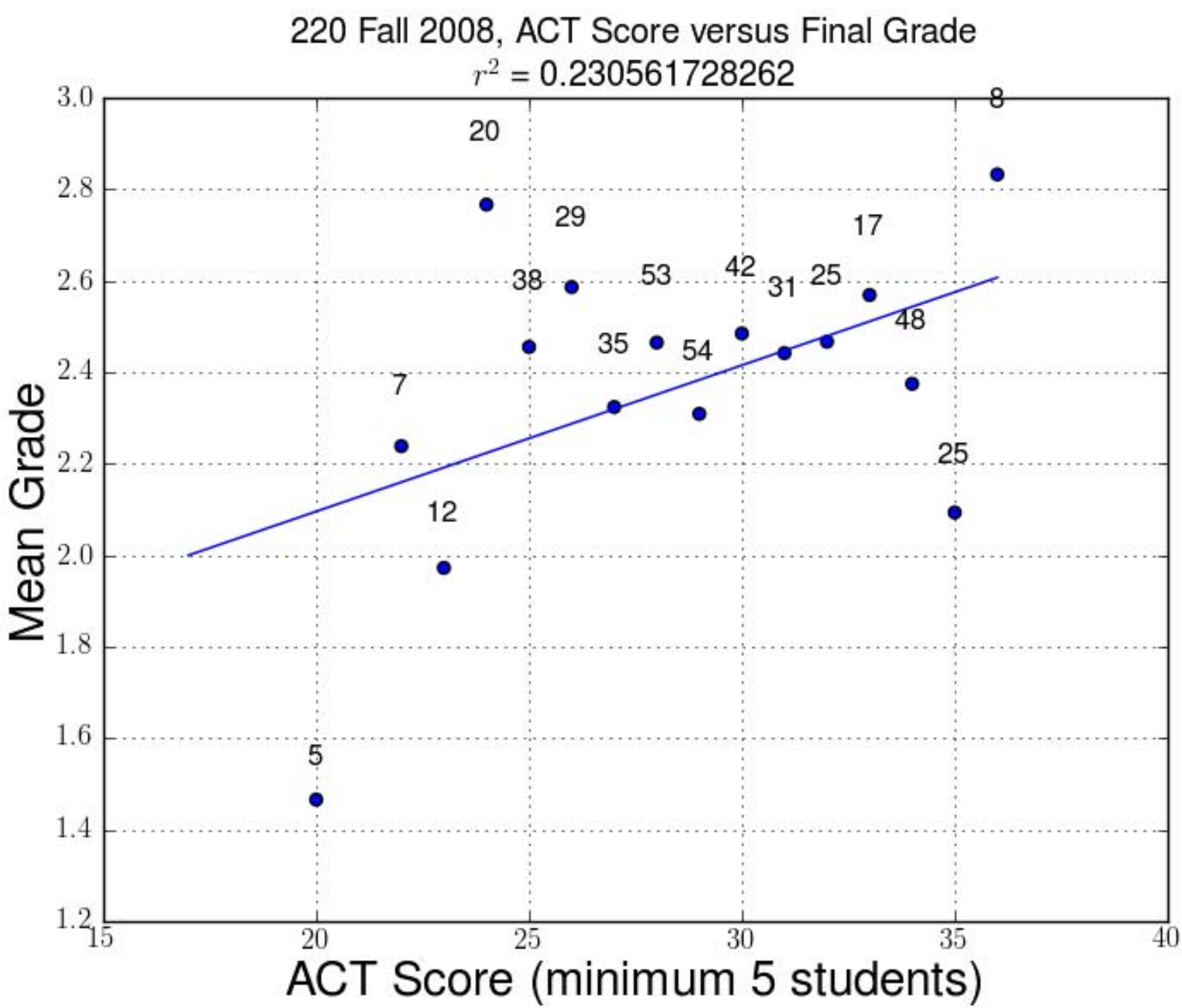
	Fall 2008 and Spring 2009														
	5 math 1550 with no LSU 1021/1022														
	Transfer Students														
	A		AU		B		C		D		F		W		Total		
		%		%		%		%		%		%		%		%	Success
LA 2 yr	3	9.4	1	3.1	6	18.8	3	9.4	2	6.3	4	12.5	13	40.6	32	100.0	37.5
LA 4 yr	6	20.0					6	20.0	7	23.3	2	6.7	9	30.0	30	100.0	40.0
Oth st 2 yr	2	25.0			3	37.5	1	12.5			1	12.5	1	12.5	8	100.0	75.0
Oth st 4 yr	3	21.4	1	7.1	6	42.9	2	14.3	1	7.1	1	7.1			14	100.0	78.6
Total	14	16.7	2	2.4	15	17.9	12	14.3	10	11.9	8	9.5	23	27.4	84	100.0	48.8

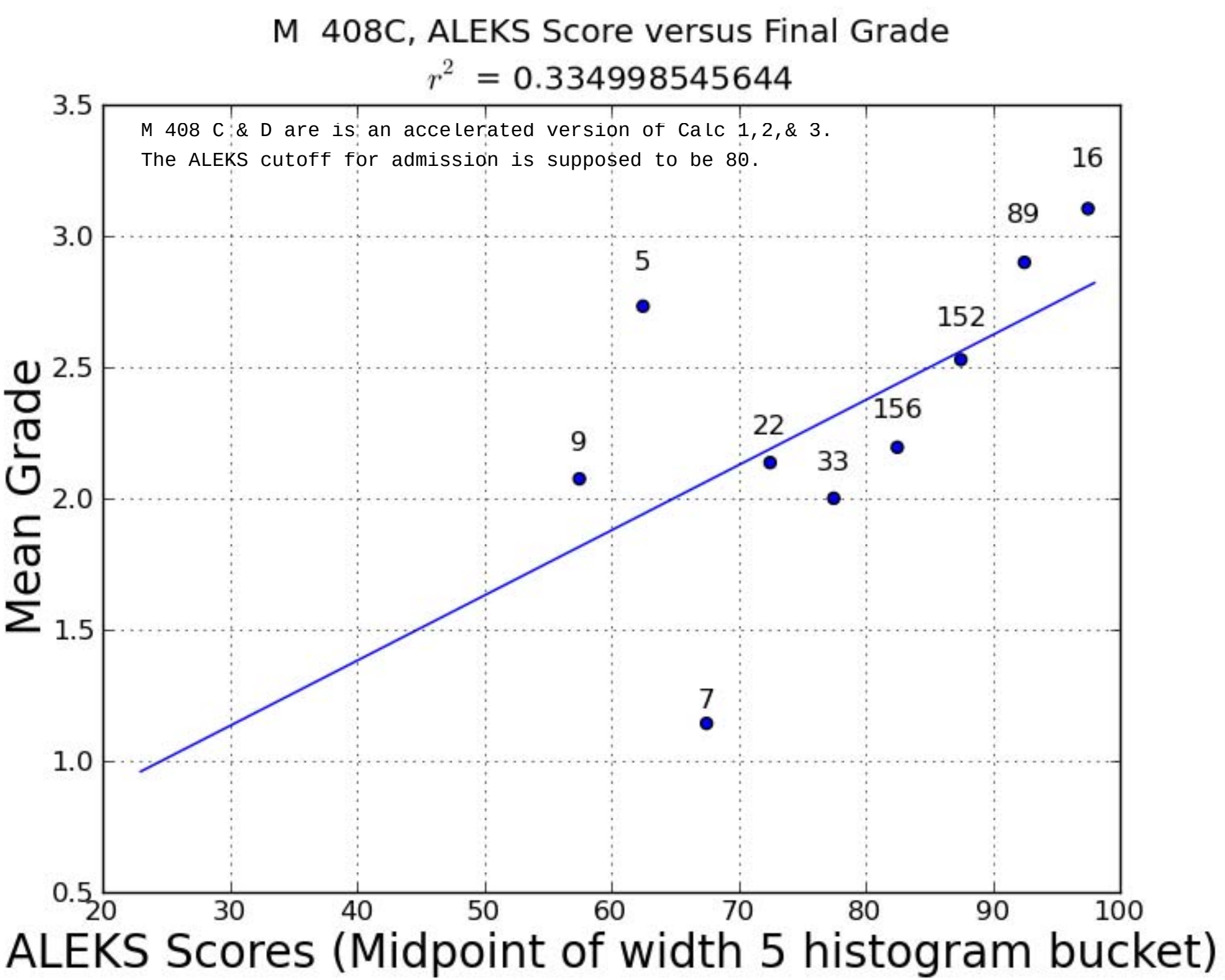
Comments: Both tables only include students taking Math 1550 for the first time.
Row 1. (top table). Freshmen taking Math 1550 in fall 2008
Row 2. Freshmen taking Math 1023 in fall 2008 and Math 1550 in spring 2009.
Row 3. Freshmen taking Math 1022 in fall 2008 and Math 1550 in spring 2009.
Row 4. Students who took both 1021 & 1022 prior to 1550. They may be upperclassmen.
Row 5. This group is largely transfers, which are broken out in the second table.

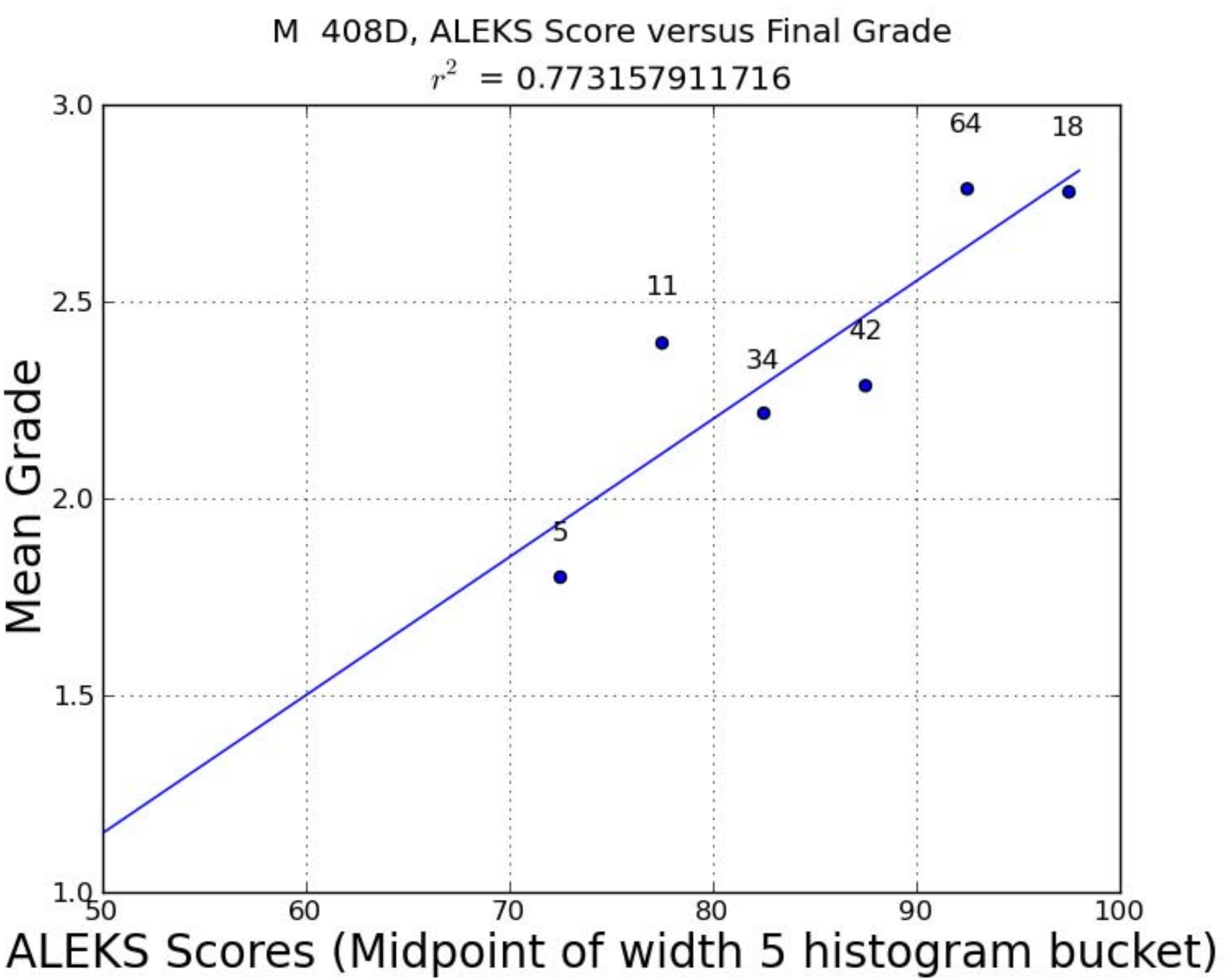
First Attempt Since Fall 2006

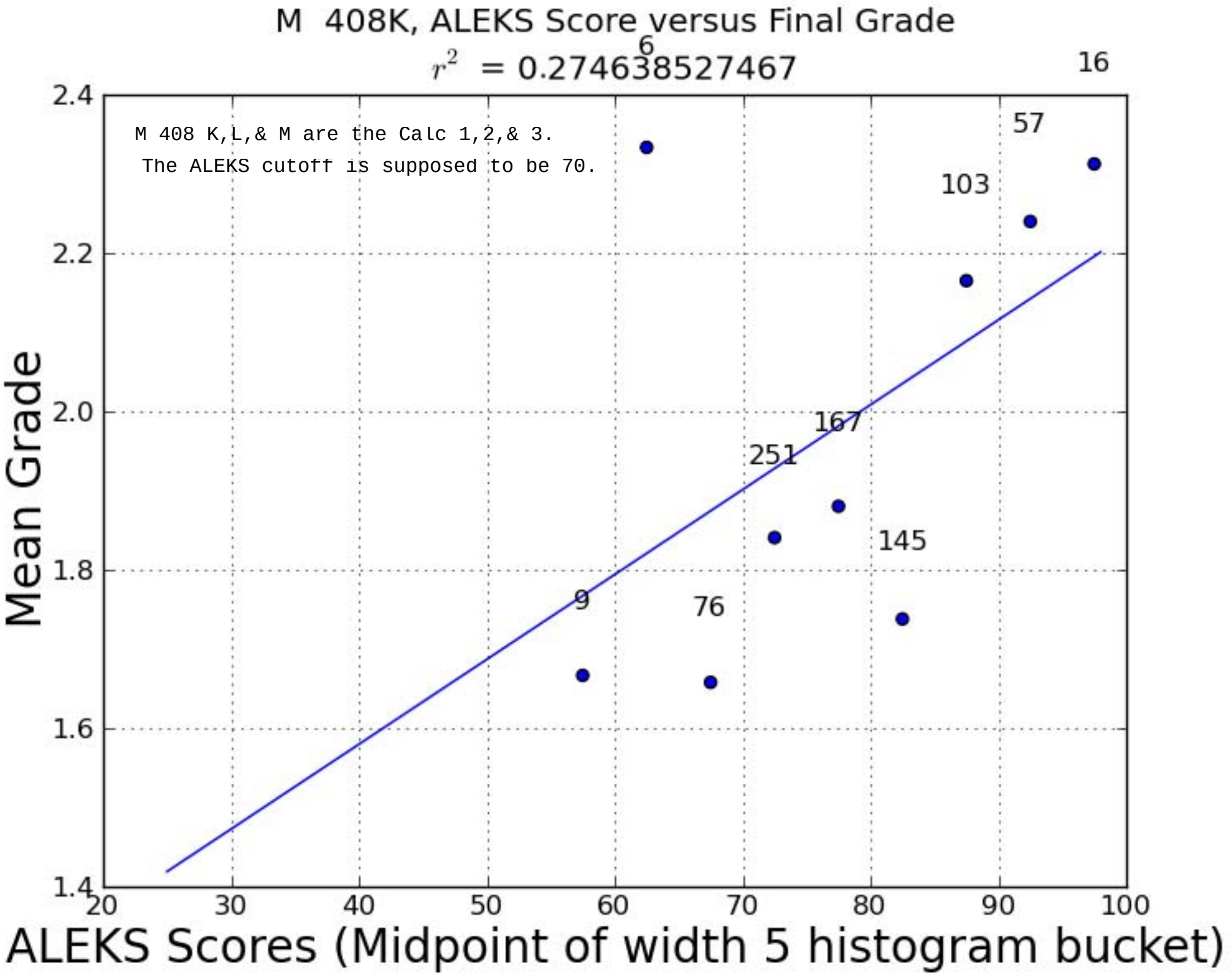
irmike.sys.prgms(math1550) stp12

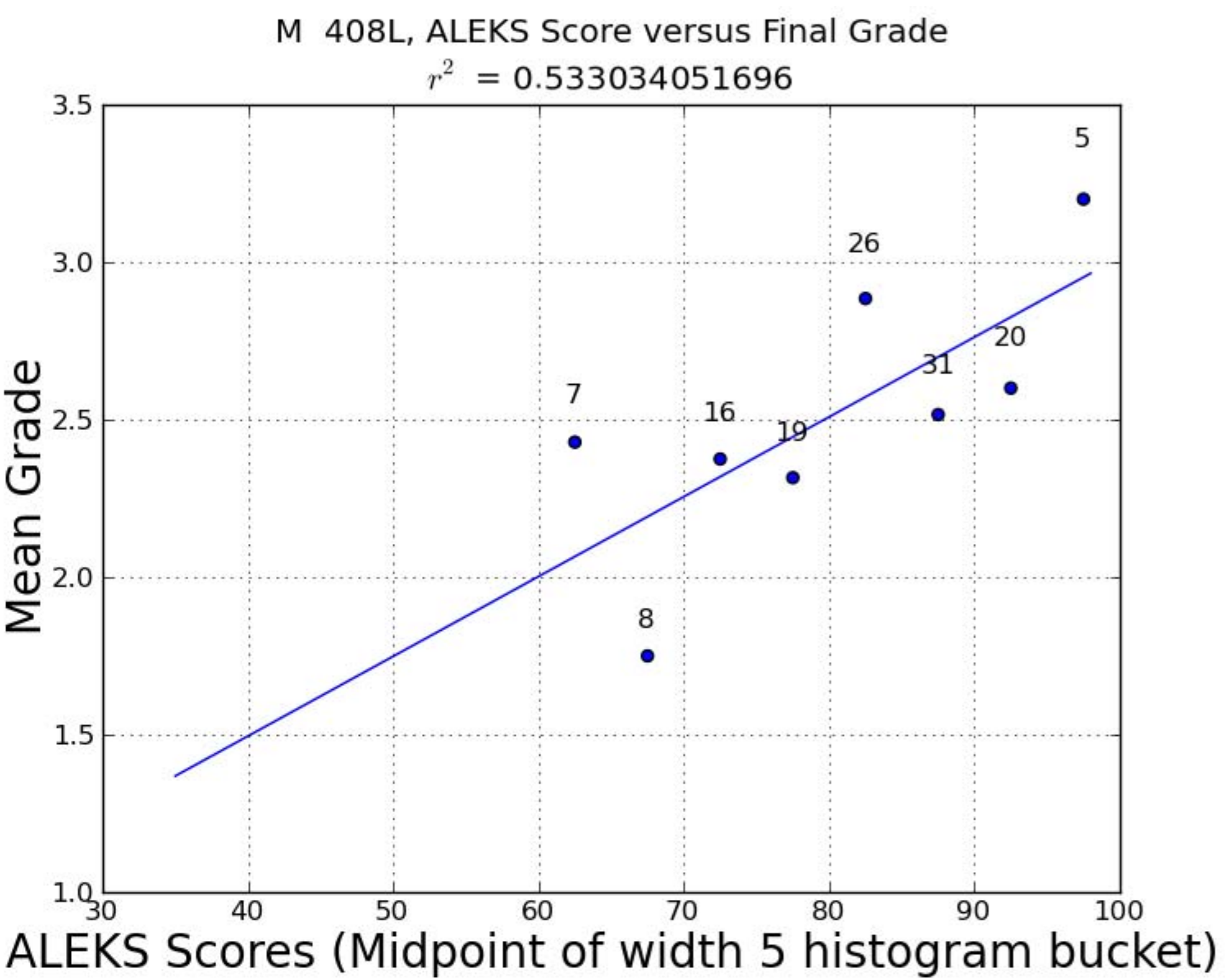

220 Fall 2008, ALEKS Score versus Final Grade
r^2 = 0.835232495434
Math 220 is Calculus 1, but UIUC also has
Math 221, for students with some previous Calculus.
ALEKS cut score is 70
32
66
149
107
88
88
Mean Grade
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
65
70
75
80
85
90
95
100
ALEKS Scores (Midpoint of width 5 histogram bucket)


220 Fall 2008, ACT Score versus Final Grade
r^2 = 0.230561728262
Mean Grade
ACT Score (minimum 5 students)
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
15
20
25
30
35
40
20
8
29
17
38
53
42
31
25
48
35
54
7
25
12
5


M 408C, ALEKS Score versus Final Grade
r^2 = 0.334998545644
M 408 C & D are is an accelerated version of Calc 1,2,& 3.
The ALEKS cutoff for admission is supposed to be 80.
16
89
5
152
156
22
9
33
7
Mean Grade
ALEKS Scores (Midpoint of width 5 histogram bucket)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
20
30
40
50
60
70
80
90
100


M 408D, ALEKS Score versus Final Grade
r^2 = 0.773157911716
3.0
2.5
2.0
1.5
1.0
Mean Grade
64
18
11
42
34
5
50
60
70
80
90
100
ALEKS Scores (Midpoint of width 5 histogram bucket)


M 408K, ALEKS Score versus Final Grade
r^2 = 0.274638527467
M 408 K,L,& M are the Calc 1,2,& 3.
The ALEKS cutoff is supposed to be 70.
6
16
57
103
167
251
145
9
76
Mean Grade
ALEKS Scores (Midpoint of width 5 histogram bucket)
2.4
2.2
2.0
1.8
1.6
1.4
20
30
40
50
60
70
80
90
100


M 408L, ALEKS Score versus Final Grade
r^2 = 0.533034051696
Mean Grade
ALEKS Scores (Midpoint of width 5 histogram bucket)
3.5
3.0
2.5
2.0
1.5
1.0
30
40
50
60
70
80
90
100
5
26
20
31
7
16
19
8