

GEORGIA COMPUTES ADVANCED PLACEMENT ANALYSIS (2010)

Executive Summary

This report responds to the following GaComputes! program outcomes:

1. Georgia will experience a 50% increase in the number of high schools offering CS AP.
2. Georgia will double the share of CS AP seats now going to women and minorities.

Examination of the AP CS exam is important because it has been found to have an impact on students choosing to major in computer science and other STEM disciplines: students who take the AP exam in CS are 10 times more likely to major in an area related to CS (Morgan & Klaric, College Board, 2007).

For 2009-2010, GaComputes! has exceeded the first program outcome by increasing the number of schools offering AP CS A by 61% (Table 1). To determine the number of schools in Georgia offering CS AP, we count the total number of schools in a given year that are approved by the College Board to use the AP CS A designation on their transcripts. In 2004, approximately 44 schools offered AP CS A. In 2007-2008, 81 schools offered AP CS A. In 2008-2009, 73 schools have the AP designation, and in 2009-2010, 71 schools have the AP designation (College Board, n.d.). There appears to be a downward trend in the number of schools offering AP CS since 2007-2008. Speculatively, fiscal problems within the state may have led to the reassignment of teachers and the cancellation of rigorous computer science courses in many schools, thus accounting for the drop in the number of schools offering AP CS A in 2008, 2009, and 2010.

Table 1. Georgia schools offering AP CS A

	Baseline (2004)	Target (50% increase)	2007-2008	2008-2009	2009-2010
Schools offering AP CS A	44	66	81 (84% increase)	73 (66% increase)	71 (61% increase)

Regarding the second program outcome, we have exceeded the target for Hispanic test takers by 12 and have not met the targets set for female and Black students. The number of female test takers increased by eight from 2008-2009 to 2009-2010 for an overall increase of 48 (69%) over the baseline. Further, the number of Black students taking the AP CS A exam fell slightly from 69 to 68. The population of Black students taking the AP CS A fluctuates considerably from one year to the next experiencing gains and losses of between 50% to 100% over the course of a year.

Table 2. Status of program outcomes regarding women and under-represented minorities

	Baseline (2004)	Year One (2007)	Year Two (2008)	Year Three (2009)	Current Year (2010)	Target	Difference
Female	70	76	108	110	118	140	-22
Black	66	40	84	69	68	132	-64
Hispanic	9	13	22	27	30	18	+12 (met)

While the number of female test takers has increased over time, their scores on the AP CS exams suggest that they are underperforming as compared to their male counterparts: approximately 48% of females pass the AP CS A exam with a score of 3 or higher compared to 58% of males. A similar pattern is found with Hispanic test takers: their numbers are steadily increasing over time yet they continue to underperform on the AP CS exam as compared to White test takers. In general, female, Black, and Hispanic test takers are scoring a 3 or higher on the AP CS exam at comparatively lower rates than male and White test takers. See Table 3.

Table 3. Percentage of test takers by gender and race/ethnicity scoring a 3 or higher on the AP CS A exam

		Baseline (2004)	Year One (2007)	Year Two (2008)	Year Three (2009)	Current Year (2010)
Gender	Female	30.0%	30.9%	32.4%	46.4%	48.3%
	Male	52.0%	54.2%	48.6%	53.5%	57.7%
Race/ Ethnicity	Black	7.6%	22.5%	10.7%	10.1%	23.5%
	Hispanic	44.4%	37.5%	38.9%	45.8%	32.1%
	White	58.7%	51.4%	53.6%	61.4%	62.8%

Advanced Placement Analysis

GaComputes! analyzes Advanced Placement data to measure progress on the following two program outcomes:

1. Georgia will experience a 50% increase in the number of high schools offering CS AP.
2. Georgia will double the share of CS AP seats now going to women and minorities

The following discussion uses advanced placement data from the College Board along with data from the United States Department of Education, the Georgia Department of Education, and the National Center for Education Statistics to determine current progress toward meeting these two outcomes.

1. Georgia will experience a 50% increase in the number of high schools offering CS AP.

Table 1 suggests that in 2009-2010, Georgia experienced a 61% increase over the 2004 baseline in the number of schools passing the AP audit and therefore qualified to teach AP CS A. Despite this gain, there appears to be a downward trend in the number of schools offering AP CS: In 2007-2008, 81 schools offered AP CS; in 2008-2009, 73 schools offered AP CS; and, in 2009-2010, 71 schools were qualified to teach AP CS (College Board, n.d.). How have budgetary issues within the state contributed to this downward trend?

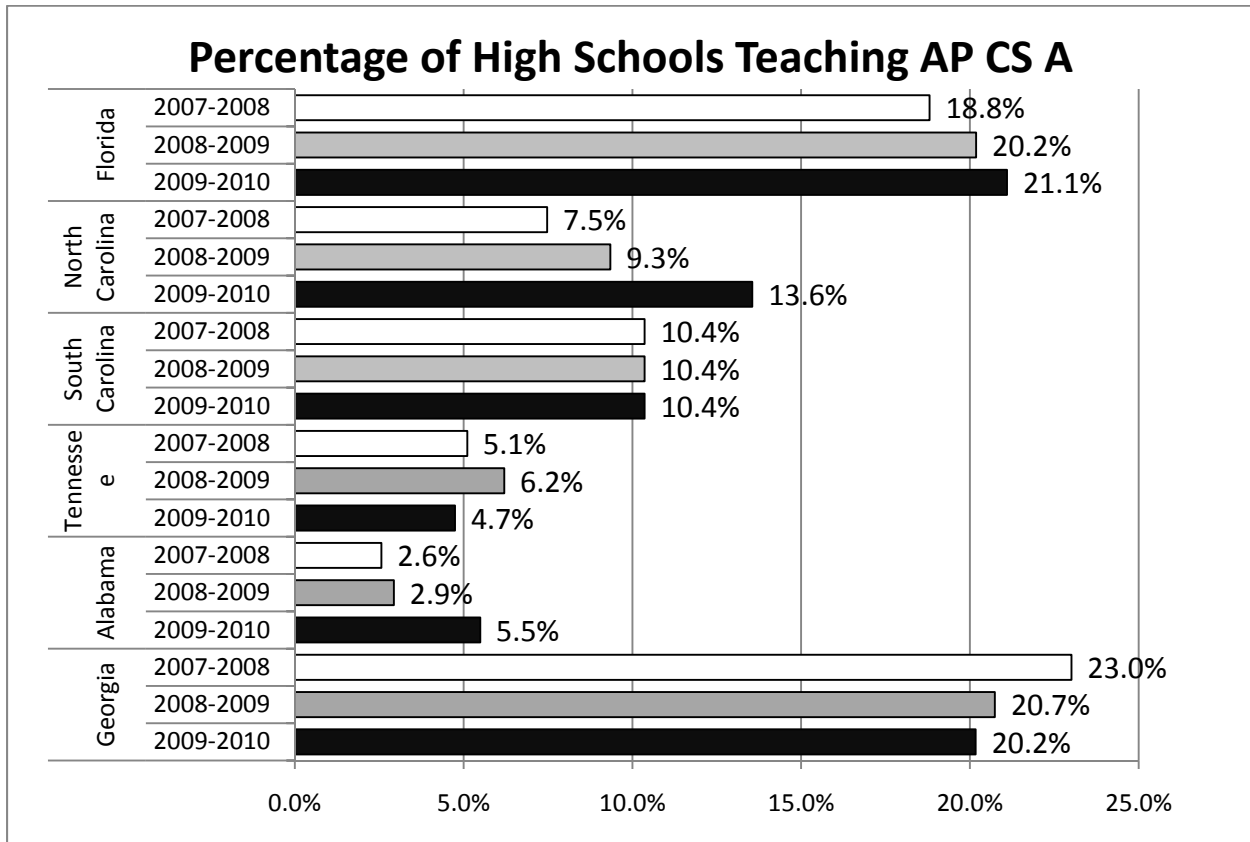


Figure 1. High schools with AP CS A designation

Interestingly, compared to other southern states, Georgia has experienced the most dramatic drop in the percentage of schools with the AP CS A designation from the College Board (Figure 1). These data were collected in November, 2010, and the College Board indicates that the schools have until January 31st, 2011 to apply for or renew their AP CS A designation.

By comparing the number of schools offering AP CS A from the College Board to the total number of schools in each state surrounding Georgia (National Center for Educational Statistics), we see that a greater percentage of Georgia schools are teaching AP CS than any neighboring state except for Florida (Table 4 and Figure 1). Data are from the National Center for Education Statistics; the number of schools by state in 2007-2008 applies to both 2008-2009 and 2009-2010 school year.

Table 4. Raw number of schools with AP CS A designation

State	NCES 2007-2008 Number of Schools by State	Schools with AP CS A Designation		
		2007-2008	2008-2009	2009-2010
Georgia	352	81	73	71
Alabama	273	7	8	15
Tennessee	274	14	17	13
South Carolina	193	20	20	20
North Carolina	428	32	40	58
Florida	436	82	88	92

2. Georgia will double the share of CS AP seats now going to women and minorities

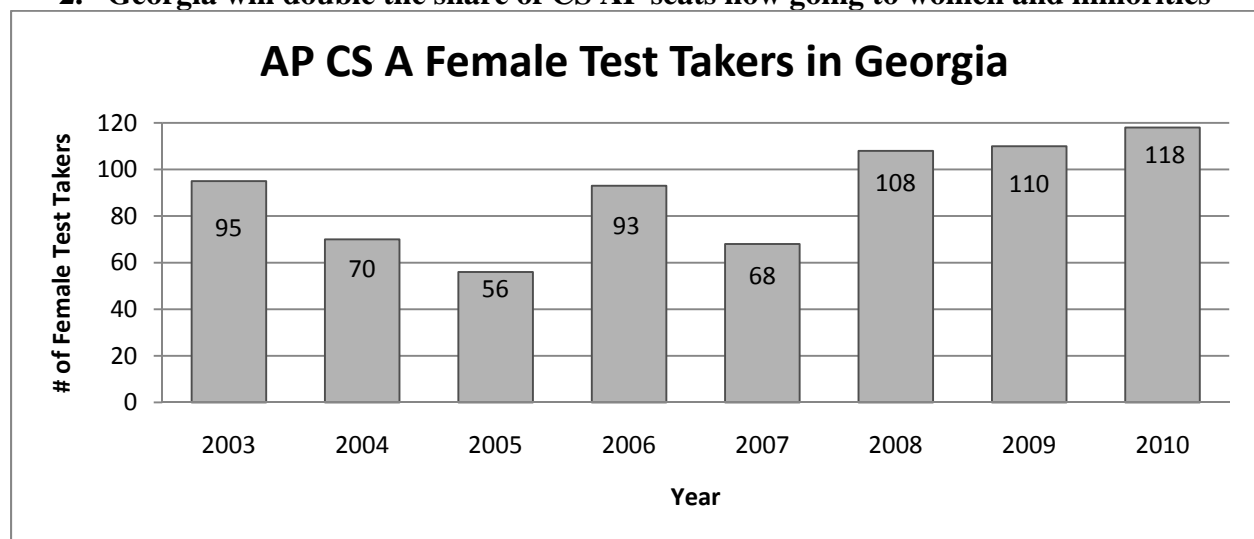


Figure 2. Female AP CS A test takers in Georgia

Using 2004 as the baseline (the year the Institute for Computing Education began), we would need 140 female test takers in Georgia in order to meet our target. From 2004 to the academic year ending in 2010, the number of female test takers has risen to 118 (see Figure 2 and Figure 5).

Figure 3 shows that the number of AP CS A test takers has increased more than any other state in the comparison, except for Alabama.¹ The number of Georgia test takers has increased by 78% from 2004 to 2010; Alabama increased by 333% from 2004 (24) to 2010 (104). Thus, despite decreases in the number of schools in Georgia offering AP CS A (see Table 1 and Figure 4), the number of students taking the CS A exam in Georgia appears to follow an upward trend. Likewise, Figure 5 shows that the increase among AP CS A test takers applies to women. Georgia has the third largest overall increase of the number of women taking the AP CS A exam (69%) between 2004 and 2010. Alabama increased from 2 to 17, an increase of 750%; Tennessee is third with 83%. Florida shows an increase of 62%.

¹ Data regarding the total number of AP exams taken by state is located in Appendix A

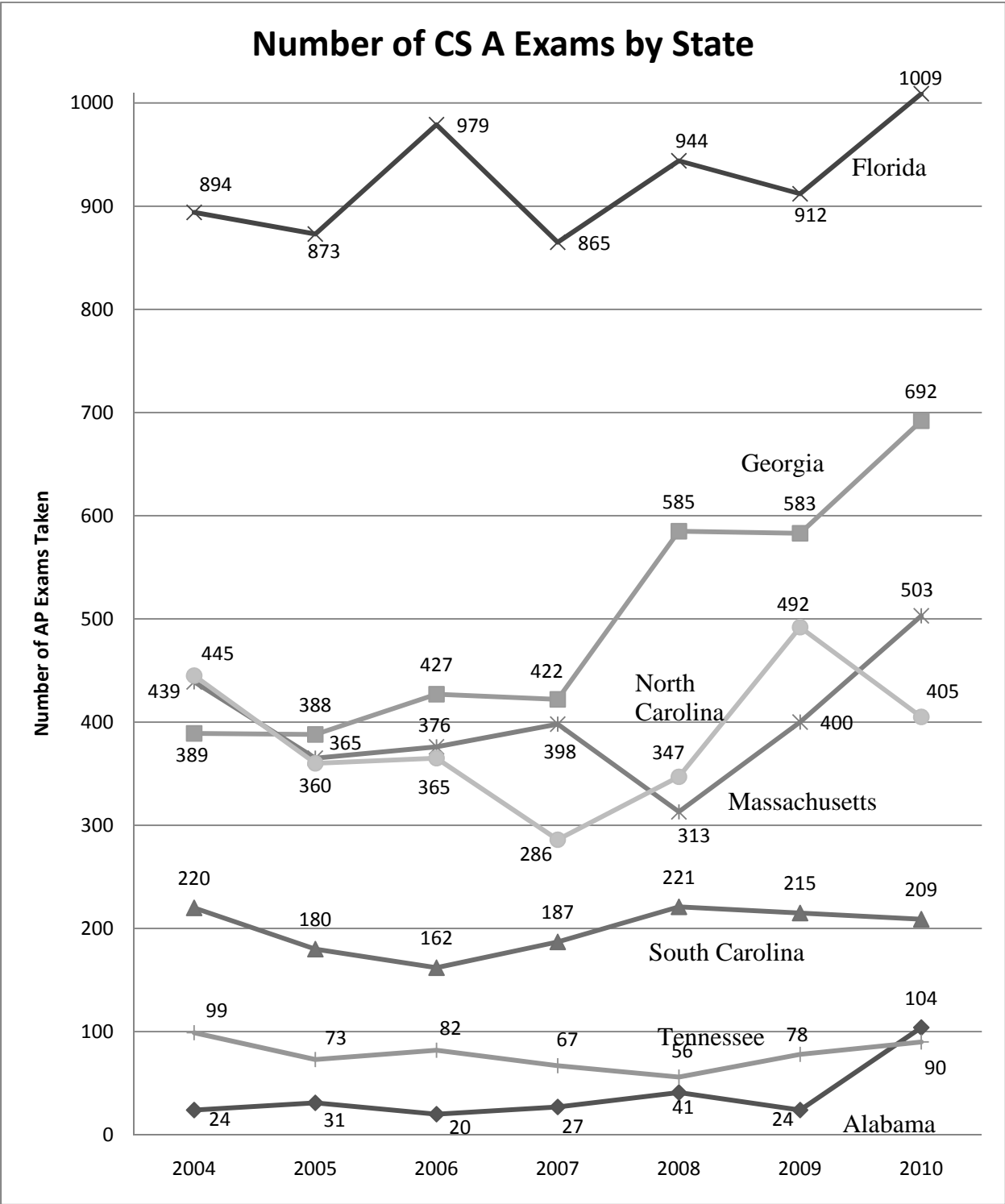


Figure 3. Annual numbers of all (male and female) AP CS A test takers by state.

Despite decreases in the number of schools in Georgia offering AP CS (see Table 1 and Figure 4), the number of students taking the CS exam continues to rise.

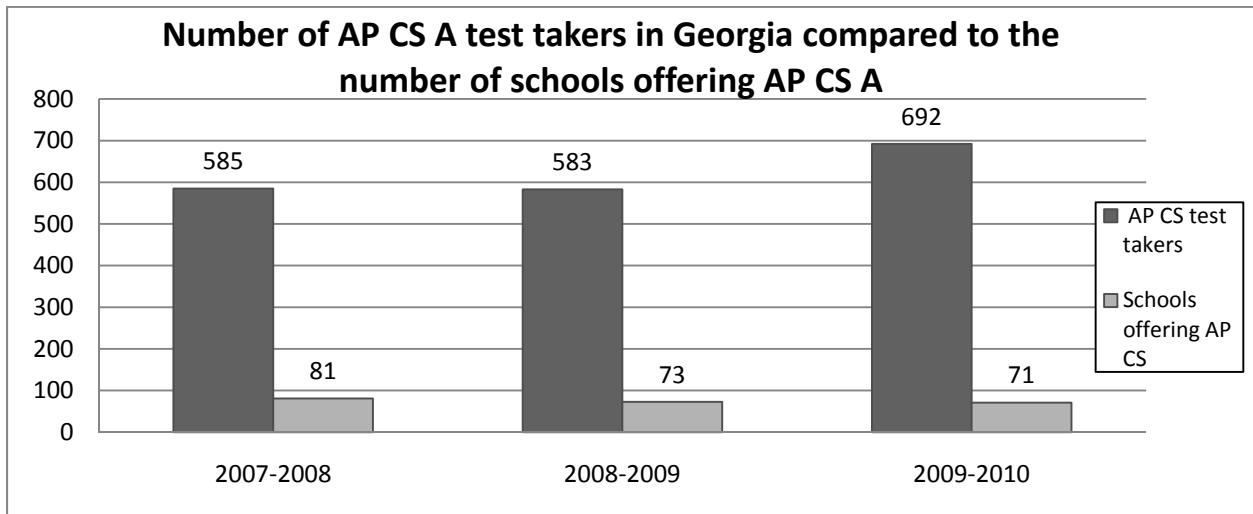


Figure 4. Number of all (male and female) AP CS A test takers compared to the number of schools offering AP CS A in Georgia

Number of CS A Exams Taken by Women

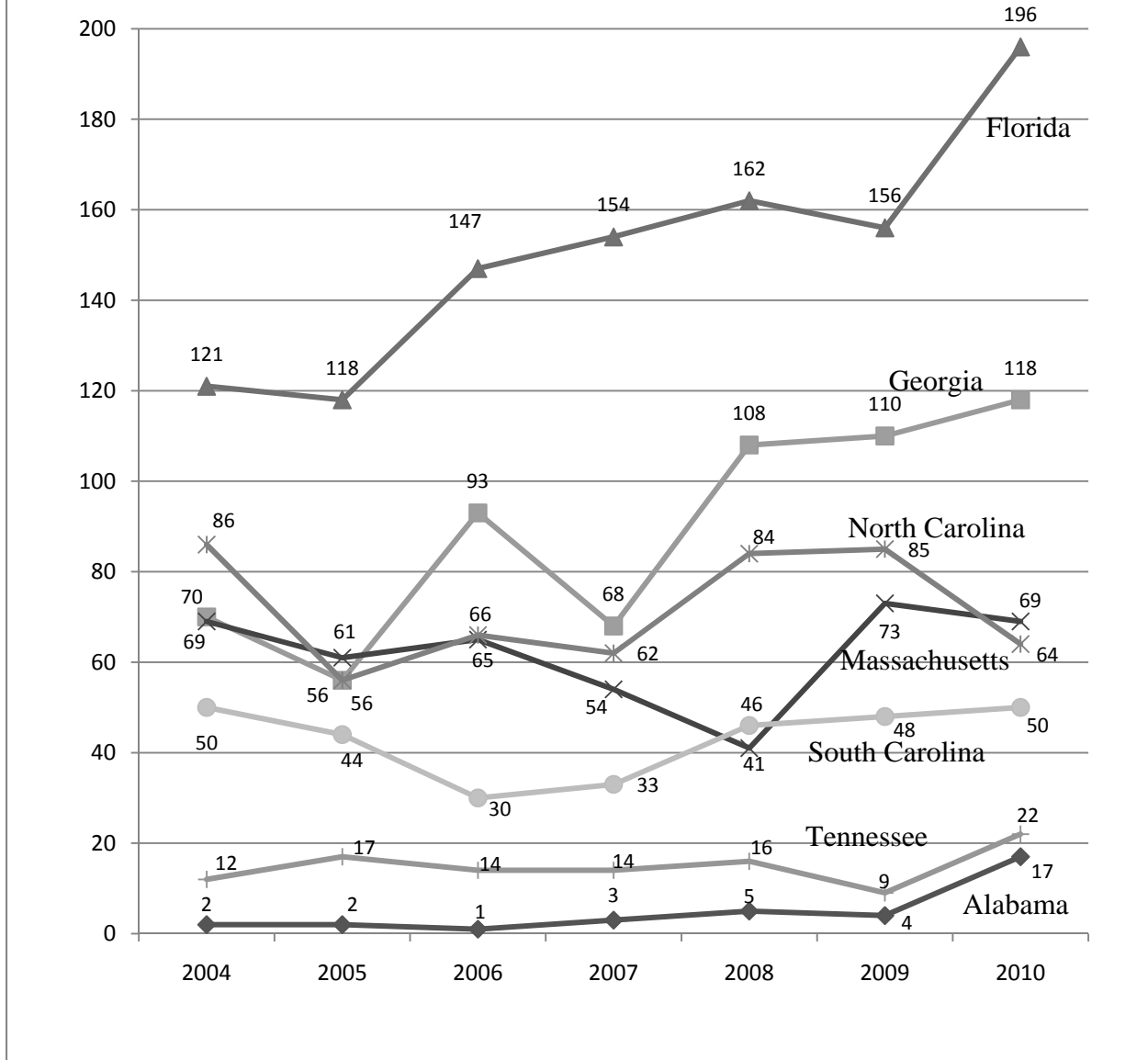


Figure 5. Female AP CS A test takers in Georgia and comparison states

Further, the Georgia data show an anomaly in 2006 which may be the effect of Barb Ericson’s challenge to CS AP teachers in Georgia to recruit and retain more women. While it is important to note the increases in 2006 and 2008, we may also note the decreases in 2005 and 2007 and ask what circumstances may have caused those declines.

Though the number of female AP CS A test takers in Georgia fluctuates over time, the total number of all female test takers and female AP CS A test takers is steadily increasing (Figure 5 and Figure 6). This is the reversal of a trend we’re seeing in undergraduate computing classrooms in which the number of female CS majors in Ph.D granting institutions has steadily declined since the mid-1980’s. Also, female test takers across all AP exams in Georgia are widening the gap over their male counterparts (Figure 7).

Comparatively, at the national level, we see an upward trend in the number of female test takers from 2004 to 2010 with a slight dip in 2005 (see Figure 6). The annual rate of growth is approximately 6.66%.

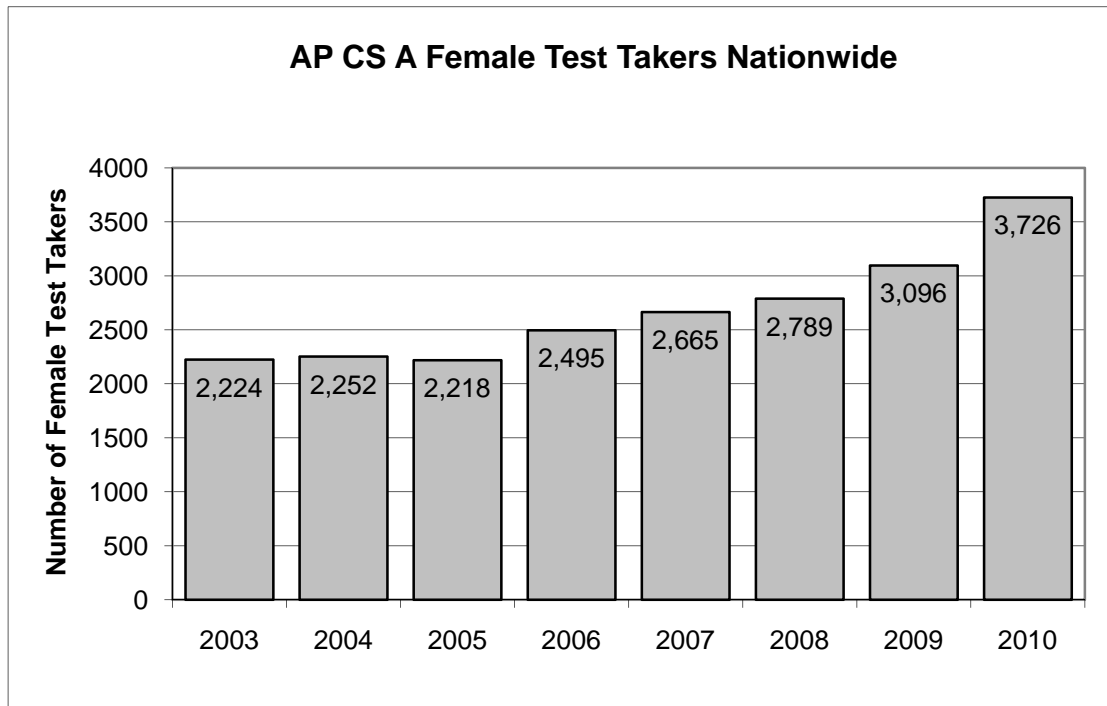


Figure 6. Female AP CS A test takers nationwide.

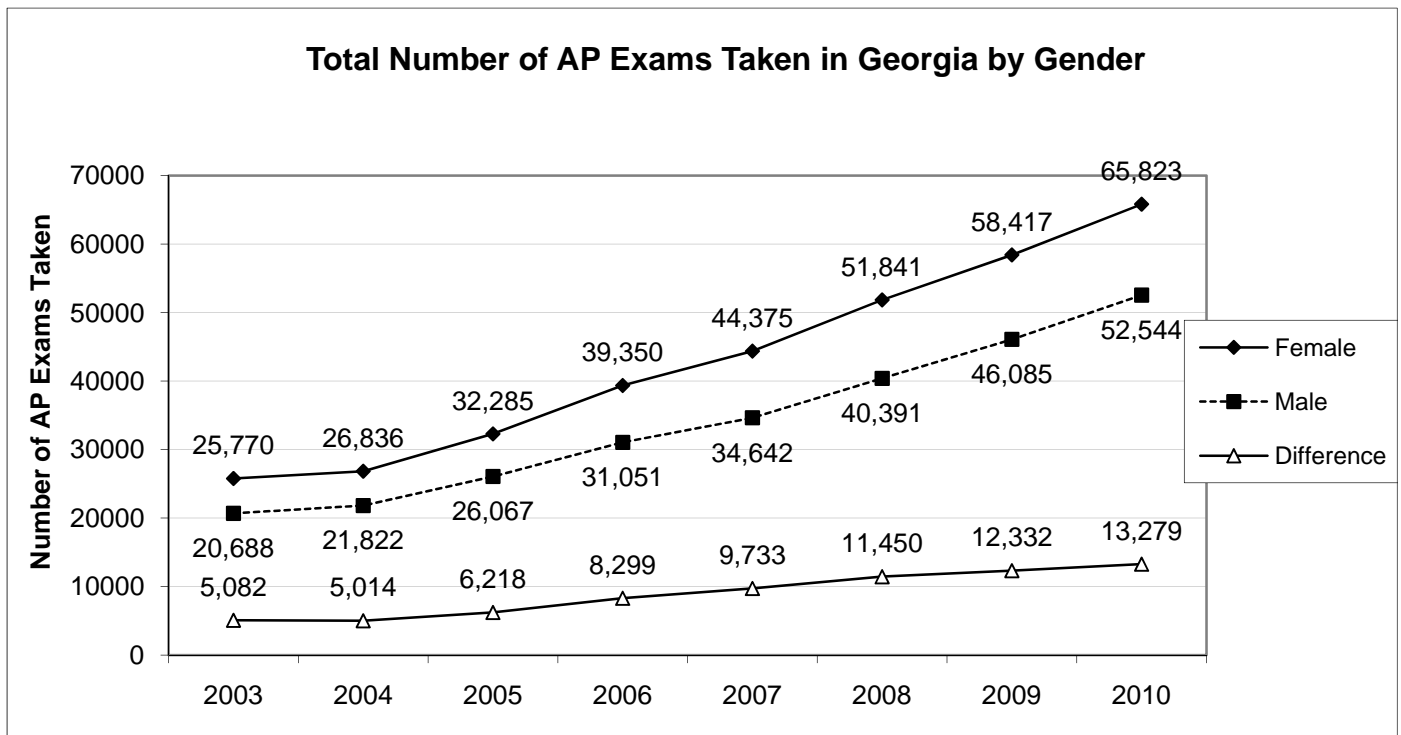


Figure 7. More women than men are taking AP exams.

Just as Georgia Computes! seeks to double the number of seats going to women, it also seeks to double the number of AP CS seats going to under-represented minorities. Figure 8 shows the race/ethnicity breakdown of AP CS A test takers in Georgia from 2004 to 2010.

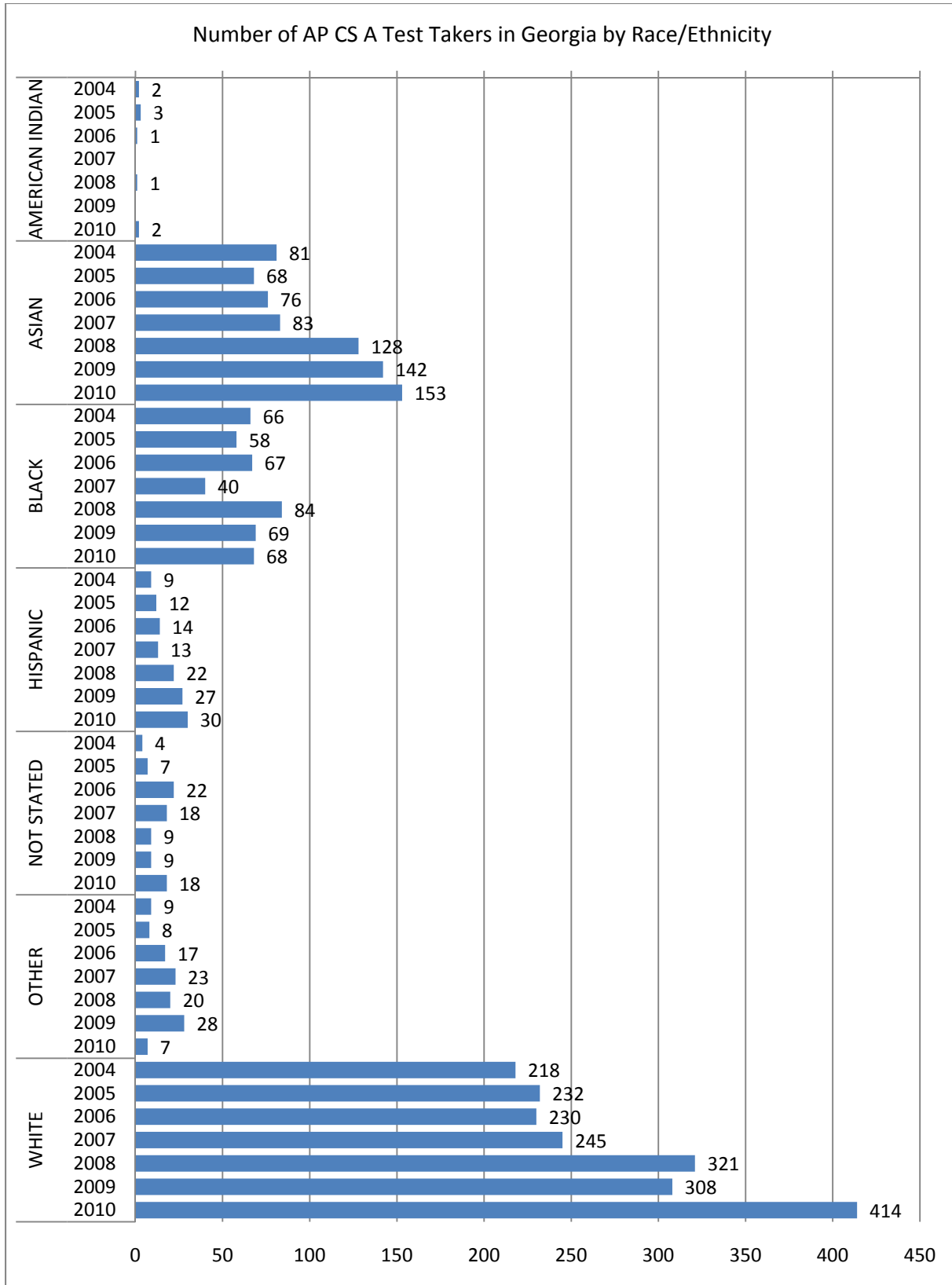


Figure 8. Georgia AP CS A test-taking population by race/ethnicity.

Since the goal is to double the number of AP CS seats going to under-represented populations, then we might set the following targets:

- American Indian: Increase from 2 in 2004 to 4 in 2010
- Black: Increase from 66 in 2004 to 132 in 2010
- Other: Increase from 9 in 2004 to 18 in 2010
- Hispanic: Increase from 9 in 2004 to 18 in 2010

Those falling in the Asian, Not Stated, and White categories are not included because Asians are an over-represented minority, the Not Stated population may encompass multiple racial/ethnic groups (both under- and over-represented), and the White population is not a minority population. Clearly, the two largest under-represented minorities, and the ones the program activities specifically target are Black and Hispanic students. For clarification, the College Board has multiple categories for what the Georgia Department of Education may consider Hispanic (e.g. Other Hispanic, Puerto Rican, Mexican American). Bill Heron at the College Board agrees that for the purposes of this report, we may place Other Hispanic, Puerto Rican, and Mexican American into the broader “Hispanic” category.

Table 5. Current status of AP participation rates by race/ethnicity.

Racial/Ethnic Group	2004 Baseline	2008 Status	2009 Status	2010 Status	2010 Target
American Indian	2	1	0	2	4
Black	66	84	69	68	132
Other	9	20 (met)	28 (met)	7	18
Hispanic	9	22 (met)	27 (met)	30 (met)	18

Table 5 shows that Georgia Computes! has met its 2010 target for Hispanic students (Mexican American, Other Hispanic, and Puerto Rican) and still has work to do to reach the 2010 target for Black and American Indian CS AP examinees. The number of Black CS AP examinees grew 27% between the baseline year and 2008 yet fell by almost as much from the 2007-2008 to the 2008-2009 and 2009-2010 school years. This decline may be a concern; another year of data will determine if this is a potential downward trend.

One challenge to doubling the number of seats going to under-represented minorities is the decrease in the number of students as they progress through high school. Georgia’s graduation rate is lowest among Black and Hispanic students. Table 6 and Table 7 show that Black and Hispanic students in Georgia have two strikes against them: their graduation rate is lower than their majority counterparts and the percentage of minority students taking the AP CS A exam is somewhat less than White students and dramatically less than Asian students.

Table 6. Graduation rates, AP CS test takers, and graduating class size in Georgia by race/ethnicity.

	2010			
	Graduation Rate*	# AP CS A test takers	Statewide Class Size*	Percentage taking AP CS A
Native Amer/Alaskan Native	80.90%	2	173	1.16%
Asian	91.00%	153	3,406	4.49%
Black	74.10%	68	43,088	0.16%
Hispanic	71.00%	30	7,113	0.42%
White	82.70%	414	55,559	0.75%

*2010 Graduation rate and statewide class size data are not available from the state as of the writing of this report (November, 2010). Graduation rates and class size data from 2009 are used instead.

Among all students, graduation rates have steadily increased from 2007 to 2009. While the percentage of students taking AP CS A has increased slightly for Asians, Hispanics, and Whites over a 4-year period, the percentage of Black test takers seems to fluctuate from one year to the next and remains at under 1/5th of a percent in 2010 (see Table 7).

Table 7. 4-year comparison of graduation rates and percentage of AP CS test takers in Georgia by race/ethnicity

	Year One (2007)		Year Two (2008)		Year Three (2009)		Current Year (2010)	
	Graduation Rate	Percentage taking AP CS A	Graduation Rate	Percentage taking AP CS A	Graduation Rate	Percentage taking AP CS A	Graduation Rate	Percentage taking AP CS A
Native Amer/Alaskan Native	65.50%	0.00%	77.10%	0.53%	80.90%	0.00%	80.90%	1.16%
Asian	86.20%	2.68%	88.70%	3.96%	91.00%	4.17%	91.00%	4.49%
Black	65.50%	0.10%	69.20%	0.20%	74.10%	0.16%	74.10%	0.16%
Hispanic	60.30%	0.23%	65.50%	0.33%	71.00%	0.38%	71.00%	0.42%
White	77.50%	0.45%	80.20%	0.56%	82.70%	0.55%	82.70%	0.75%

*2010 Graduation rate and statewide class size data are no available from the state as of the writing of this report (November, 2010). Graduation rates and class size data from 2009 are used instead.

Looking beyond test-taking patterns to performance on the AP CS exams, we see a deeper difference in the performance of under-represented minorities. Table 8 shows that approximately 58% of Asian test takers and 61% of White test takers score a 3 or higher on the AP CS A exam. In contrast, approximately 32% of Hispanic and 24% of Black test takers score a 3 or higher. Of note, there was a 13% increase in the number of Black test takers scoring a 3 or higher from 2009 to 2010 and a 16% increase from 2004 to 2010. Perhaps the most urgent piece of data, however, is the number of Black students scoring a “1” on the AP CS A exam: In 2010, 68% of Black students received the lowest score possible, compared to 30% of Whites and 34% of Asians.

Table 8. Combined percentage of test takers by race/ethnicity scoring a 3 or higher on the AP CS A exam along with numbers of test takers at each performance level.

Race/ Ethnicity	Year	3 or Higher (reference lines at 30% and 50%)	CS A Test Takers at Each Grade Level					
			1	2	3	4	5	
Asian	2004	56.8%		31	4	10	19	17
	2005	52.9%		28	4	10	13	13
	2006	53.9%		32	3	7	18	16
	2007	62.7%		23	8	17	24	11
	2008	50.8%		52	11	13	27	25
	2009	55.6%		48	15	23	30	26
	2010	57.5%		52	13	14	37	37
Black	2004	7.6%		61	0	3	2	0
	2005	12.1%		46	5	3	4	0
	2006	3.0%		61	4	2	0	0
	2007	22.5%		28	3	3	4	2
	2008	10.7%		70	5	3	5	1
	2009	10.1%		56	6	2	3	2
	2010	23.5%		46	6	10	5	1
Hispanic	2004	44.4%		5	0	0	3	1
	2005	40.0%		6	0	1	1	2
	2006	30.0%		6	1	1	1	1
	2007	37.5%		4	1	1	0	2
	2008	38.9%		9	2	3	1	3
	2009	45.8%		11	2	5	4	2
	2010	32.1%		14	5	3	1	5
White	2004	58.7%		68	22	31	46	51
	2005	56.0%		82	20	24	53	53
	2006	45.2%		104	22	21	44	39
	2007	51.4%		89	30	40	44	42
	2008	53.6%		121	28	55	67	50
	2009	61.4%		90	29	53	87	49
	2010	62.8%		125	29	56	119	85

Examining differences in the performance of females on the AP CS exams, Table 9 shows that approximately 48% of female test takers score a 3 or higher compared to approximately 58% of male test takers. On average, there is a 3% increase per year (since 2004) in the number of female test takers who score a 3 or higher on the AP CS A exam. Of concern, however, is the number of female students scoring a “1” on the AP CS exam: In 2010, 48% of females scored the lowest possible score compared to 33% of males.

Table 9. Combined percentage of test takers by gender scoring a 3 or higher on the AP CS A exam along with numbers of test takers at each performance level.

Gender	Year	3 or Higher (reference lines at 30% and 50%)		CS A Test Takers at Each Grade Level				
				1	2	3	4	5
Female	2003	46.3%		44	7	12	18	14
	2004	30.0%		44	5	6	13	2
	2005	35.7%		34	2	4	7	9
	2006	22.6%		68	4	9	7	5
	2007	30.9%		36	11	11	7	3
	2008	32.4%		62	11	13	12	10
	2009	46.4%		52	7	11	27	13
	2010	48.3%		57	4	15	30	12
Male	2003	56.5%		130	28	56	83	66
	2004	52.0%		131	22	39	59	68
	2005	48.8%		139	31	34	68	60
	2006	43.4%		154	35	25	64	56
	2007	54.2%		128	34	58	74	60
	2008	48.6%		205	40	67	94	71
	2009	53.5%		171	49	78	105	70
	2010	57.7%		191	52	74	137	120

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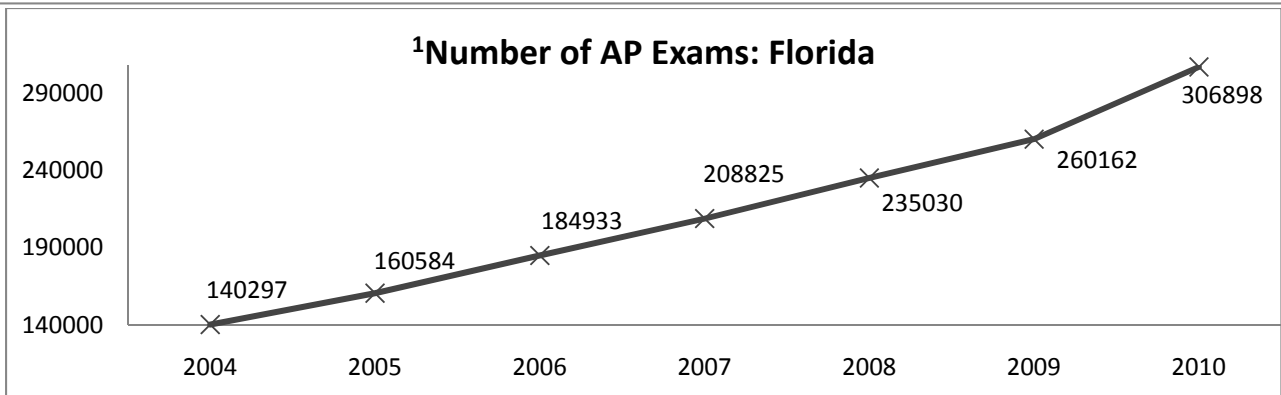
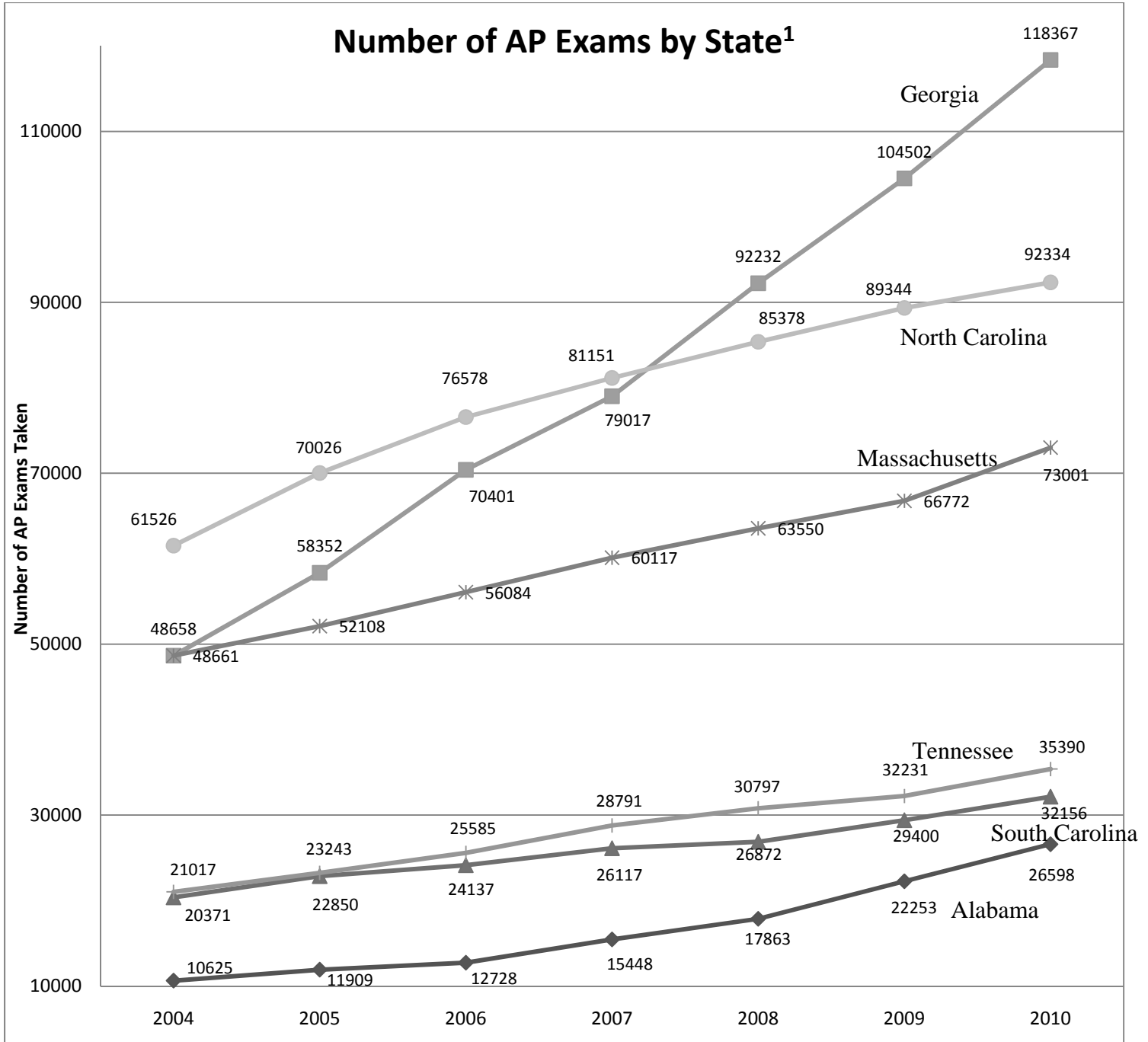
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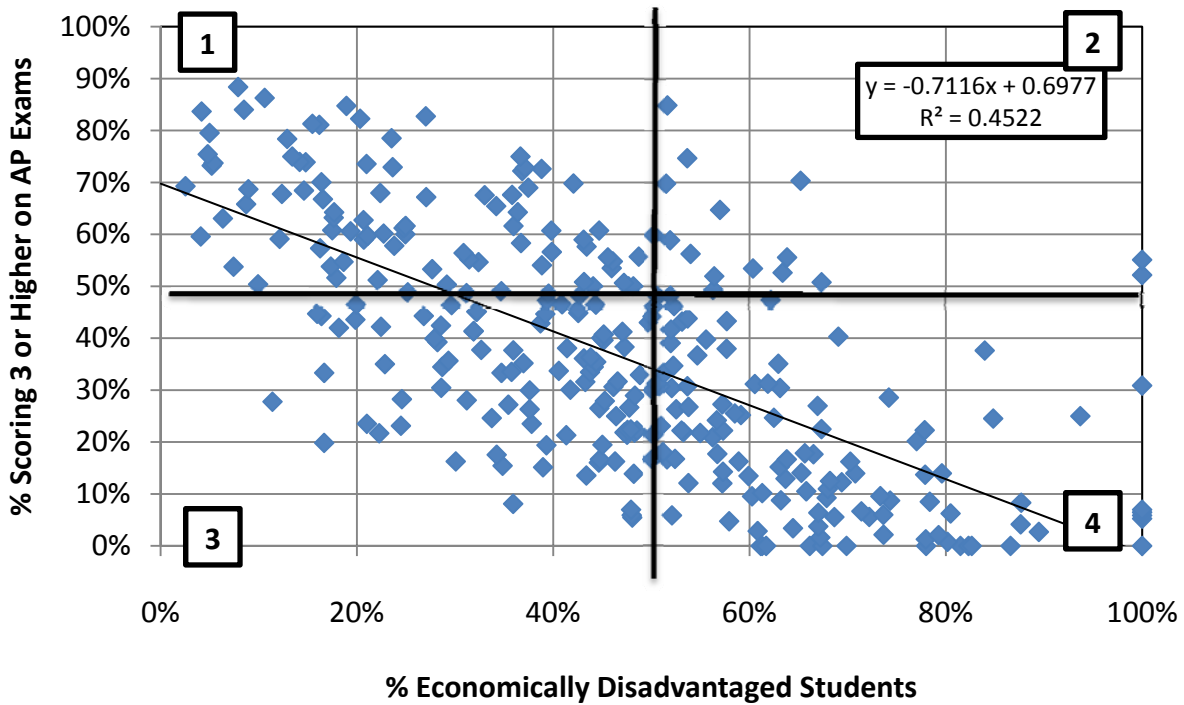
U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), “Public Elementary /Secondary School Universe Survey,” 2007–08, Version 1a.

Appendix A: Count of AP Exams taken by State



Appendix B: Comparison of Economically Disadvantaged Students with AP Exam Performance

Georgia High Schools Scoring 3 or Higher on AP Exams by Percentage of Economically Disadvantaged Students



The figure above shows a scatter plot of the 330 schools in Georgia with students who took any AP exam during the 2009-2010 school year. The scatter plot compares schools by the percentage of economically disadvantaged students attending and by the percentage of students scoring a three or higher on AP Exams taken by their students. Notice a strong negative correlations ($r=-0.67$) showing that schools with fewer economically disadvantaged students tend to have students who pass AP exams with a 3 or higher.

Quadrant	N Schools	Percentage of Schools
1	80	24%
2	15	5%
3	105	32%
4	130	39%

Further, we may divide the scatter plot into four quadrants by drawing horizontal and vertical lines at the both 50% marks. Quadrant four contains the schools with the greatest percentage of economically disadvantaged students and the lowest percentage of students scoring a 3 or higher on AP exams, and most disturbingly, this is the quadrant with the greatest percentage of schools (39%). Only 5% of schools sending students to AP exams defy the odds by having a high percentage of economically disadvantaged students AND a high percentage of students passing the AP.