AP Computer Science A: 2019 Reading Results

John Cigas, Chief Reader

Park University

Parkville, MO

July 19, 2019
Orlando, FL

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Agenda

- AP Computer Science A Exam Overview
- The AP Computer Science A Reading Processes
- The Scoring Guidelines and Notes for the AP Computer Science A Free Response Questions
- 2019 AP Computer Science A Overall Score Distribution
- Student Performance by Question/Task
- General Advice to AP Computer Science A Teachers
- How to Become an AP Reader

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AP Computer Science A Exam Overview

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AP Computer Science A and Exam Development Committee

- **Co-Chairs**
  - Adrienne Decker — University at Buffalo (Buffalo, NY)
  - Sandy Czajka — Brookfield High School (Riverside, IL)
- **College Board Advisor**
  - Robert Medrano — Weslaco High School (Weslaco, TX)
- **Members**
  - Briana Morrison — University of Nebraska-Omaha (Omaha, NE)
  - Yilun Xu — Bryn Mawr College (Bryn Mawr, PA)
  - Ria Galanos — Thomas Jefferson High School (Alexandria, VA)
  - Tim Gallagher — Winter Springs High School (Winter Springs, FL)
- **Chief Reader**
  - John Cigas — Park University (Parkville, MO)
- **ETS Test Developer**
  - Roslyn Franklin

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Structure of AP Computer Science A Exam

The exam will always follow specific criteria regarding the number of items in certain categories.

Section Number	Number and Type of Questions	Weight	Time Allotted	
1	40 Multiple-choice questions *(5 possible responses A, B, C, D, E)*	50%	90 minutes	
2	FRQ 1: Methods and Control Structures	12.5%	22.5 minutes	Total: 90 minutes
	FRQ 2: Class	12.5%	22.5 minutes	
	FRQ 3: Array/`ArrayList`	12.5%	22.5 minutes	
	FRQ 4: 2D Array	12.5%	22.5 minutes	

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Question Development and Exam Assembly

Multiple forms developed every year

1. **Initial Draft of Questions**
   AP community teachers and faculty; Test Development Committee
2. **Question Review and Revision**
   Test Development Committee; Content experts
3. **Pre-Testing and Statistical Analysis – Clarity, difficulty, etc.**
   Psychometricians
4. **Higher Ed Exam Review**
   Chief Reader; Higher Ed Co-Chair of Test Development Committee
5. **"Fresh Eyes" Review**
   Additional Higher Ed experts

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The Reading

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What the AP Computer Science A Readers Might See

About the AP Computer Science A Reading - 2019

- Kansas City, MO
- 70,088 Exams
- 325 Teachers
  - 265 Readers
  - 57 Leaders

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AP Computer Science A Volume Growth

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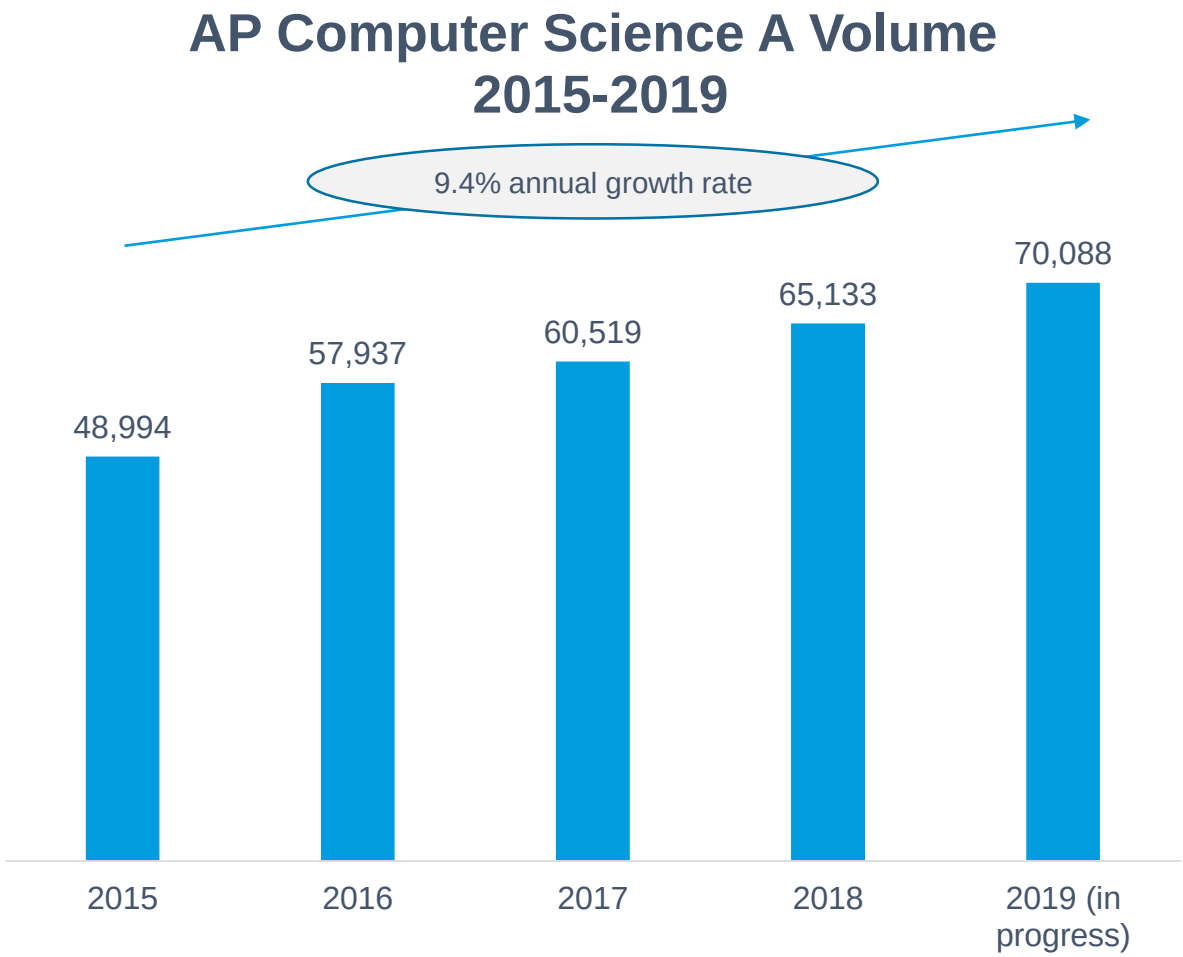
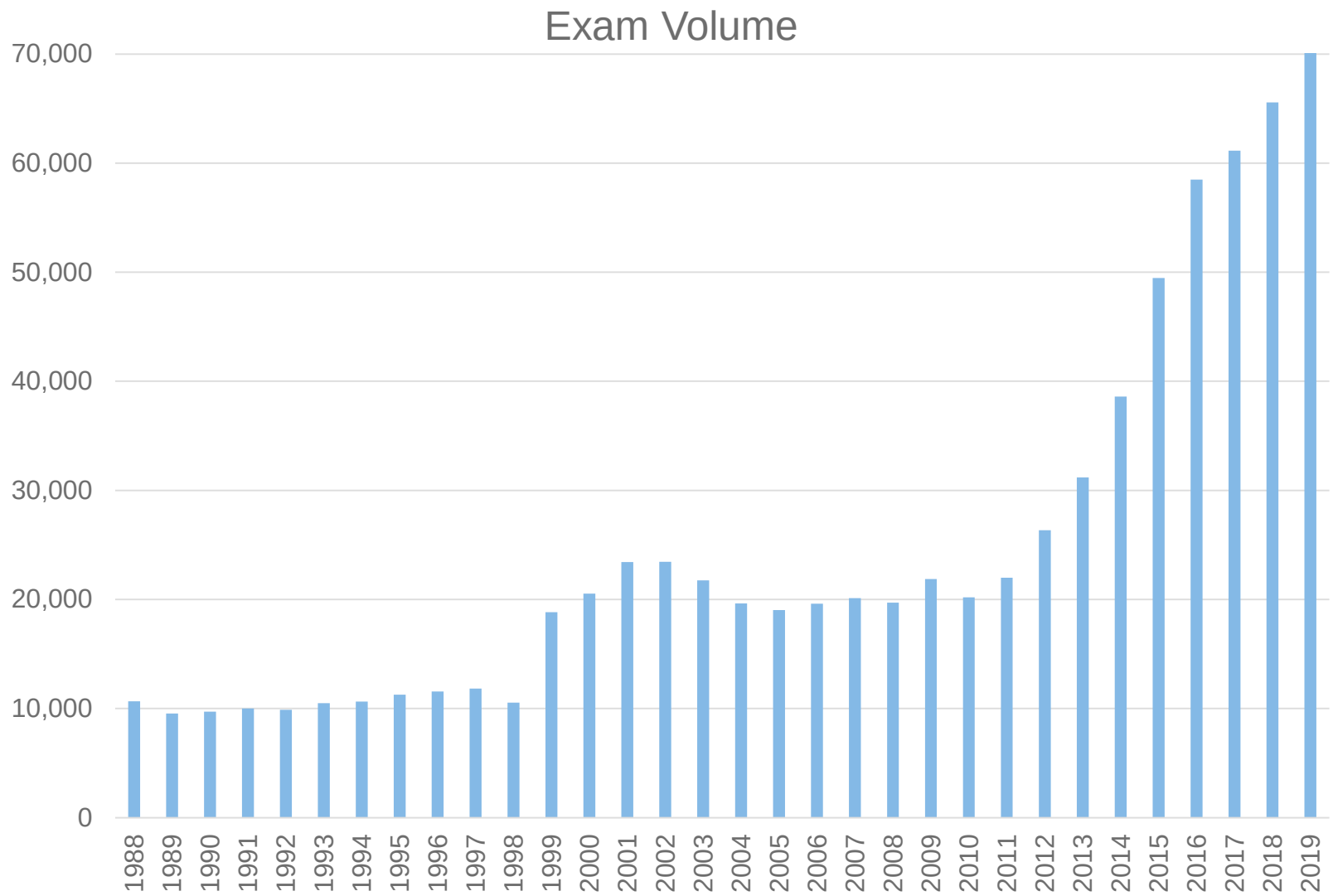


AP Computer Science A Volume Growth



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Activities

- Social lounge (hotel)
  - Games, puzzles, ping pong
- Toy night (Pedagogical Practices)
  - Teaching tips and tricks
- Professional Night
- Puzzle Night
- DC and College Board Forum
- Dine out night
- Self organized groups
  - Walking, running, Pokemon Go
  - Royals, art galleries

AP Reading – Computer Science A

We are continuing to plan for online scoring for CSA at the AP Reading

As with other subjects

- Leadership is onsite during the reading
- Some readers score items online from home, managing their own schedule
- Readers asked if they prefer to score onsite or from home

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- We held an online distributed scoring pilot in July 2018 to:
  - Learn how best to configure the scoring system
  - Learn effective training approaches for distributed readers
  - Study reliability scores and reader experience.
- ODS Reader Reliability Study Summary for Computer Science A showed no mode impact between onsite reading and ODS
- Survey of AP Pilot Readers to gauge their level of satisfaction with the 2018 Pilot Reading
  - 22 of 23 AP CSA respondents found the rubric training effective in helping to accurately score exams
  - 21 of 23 AP CSA respondents indicated receiving feedback from leadership on mastery of the learning outcomes
  - 19 of 23 AP CSA respondents indicated satisfaction with their overall online scoring experience

How to become an AP Reader

- College & University Faculty
  - ***aphighered.collegeboard.org***
  - Click on "**Get Involved**"
  - Choose "**Become an AP Reader**"

- Experienced High School Teachers
  - ***apcentral.collegeboard.org***
  - Click on "**Professional Development**"
  - "**Become an AP Reader**"

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Scoring the AP Computer Science A Exam

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Scoring the AP Computer Science A Exam

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Each student response is scored with these principles in mind:

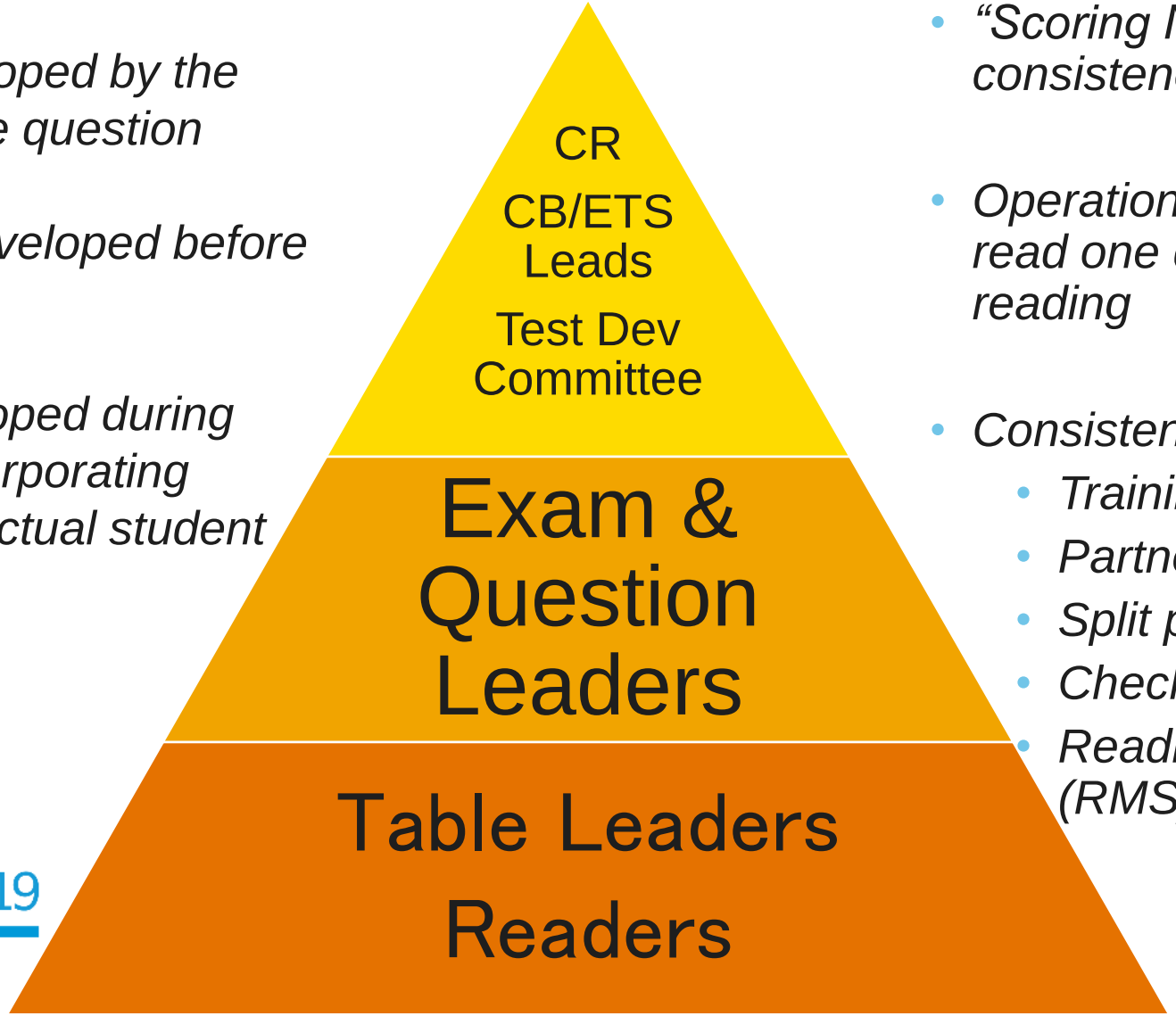
- accuracy
- fairness
- consistency

To ensure these, readers are trained to score responses based exclusively on the scoring guidelines.

Ensuring Accuracy, Fairness, and Consistency

Scoring Criteria

- *Initial draft developed by the DC alongside the question*
- *Detailed draft developed before pre-reading*
- *Final draft developed during pre-reading, incorporating examples from actual student work*



- *"Scoring Notes" ensure consistency*
- *Operational exam readers usually read one question the entire reading*
- *Consistency checks*
  - *Training packs*
  - *Partner system*
  - *Split packs*
  - *Check-reading*
  - *Reading Management System (RMS) metrics*

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How Students Earn Points

2019 AP® COMPUTER SCIENCE A FREE-RESPONSE QUESTIONS

COMPUTER SCIENCE A
SECTION II

Time—1 hour and 30 minutes

Number of questions—4

Percent of total score—50

Directions: SHOW ALL YOUR WORK. REMEMBER THAT PROGRAM SEGMENTS ARE TO BE WRITTEN IN JAVA.

Notes:

- Assume that the interface and classes listed in the Java Quick Reference have been imported where appropriate.
- Unless otherwise noted in the question, assume that parameters in method calls are not `null` and that methods are called only when their preconditions are satisfied.
- In writing solutions for each question, you may use any of the accessible methods that are listed in classes defined in that question. Writing significant amounts of code that can be replaced by a call to one of these methods will not receive full credit.

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How Student Responses are Scored

- Every scorable element earns one point or zero
- Each element is scored independently as much as possible
  - Limit double jeopardy
  - Limit ripple effects
- Students must use existing code where appropriate.

Scoring Guidelines

```
public static int numberOfLeapYears(int y1, int y2)
{
    int count = 0;
    for (int y = y1; y <= y2; y++)
       if (isLeapYear(y))
          count++;
    return count;
}
```

+1	Initializes a numeric variable
+1	Loops through each necessary year in the range
+1	Calls `isLeapYear` on some valid year in the range
+1	Updates count based on result of calling `isLeapYear`
+1	Returns count of leap years

Scoring Notes

Part (a) numberOfLeapYears			5 points
Points	Rubric Criteria	Responses earn the point even if they...	Responses will not earn the point if they...
+1	Initializes a numeric variable		• use the variable for loop control only
+1	Loops through each necessary year in the range		• consider years outside the range
+1	Calls isLeapYear on some valid year in the range	• do not use a loop	
+1	Updates count based on result of calling isLeapYear	• do not use a loop • do not initialize the counter	• use result as a non-boolean
+1	Returns count of leap years	• loop from year1 to year2 incorrectly • do not initialize the counter	• do not use a loop • update or initialize the counter incorrectly • return early inside the loop

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Chief Reader Report

Common Misconceptions/Knowledge Gaps *Write program code to satisfy methods using expressions, conditional statements, and iterative statements.*	*Responses that Demonstrate Understanding*
Students did not initialize local variables before use. `int count;` or did not declare a local variable at all	`int count = 0;`

Students did not consider all years in the specified range
 	
`for (int y = year1; y < year2; y++)`
`  if (isLeapYear(y)) count++;`
 	
or
 	
`for (int y = year1 + 1; y <= year2; y++)`
`  if (isLeapYear(y)) count++;`
	`for (int y = year1; y <= year2; y++)`
	`  if (isLeapYear(y)) count++;`

Students looped over the length of the range, rather than the years in the range, but did not adjust for these loop bounds when calling `isLeapYear`.
 	
`int diff = year2 - year1;`
`for (int y = 0; y <= diff; y++)`
`  if (isLeapYear(y)) count++;`
	`int diff = year2 - year1;`
	`for (int y = 0; y <= diff; y++)`
	`  if (isLeapYear(year1 + y)) count++;`

Students returned early inside the loop instead of returning after checking all the years in the range.
 	
`for (int y = year1; y <= year2; y++)`
`  if (isLeapYear(y))`
`  count++;`
`  else`
`  return count;`
	`for (int y = year1; y <= year2; y++)`
	`  if (isLeapYear(y)) count++;`
	`return count;`

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AP Computer Science A:

2019 Score Distribution

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AP Computer Science A Exam Score Distribution

69.5% *of students scored 3 or higher*

So far, ***648*** *students have scored a perfect 80/80*

AP Exam Score	Approximate % Students EARNING this AP Score	Approximate % Students BELOW this AP Score
5	26.73%	73.26%
4	21.9%	51.35%
3	20.86%	30.49%
2	11.86%	18.62%
1	18.62%	NA

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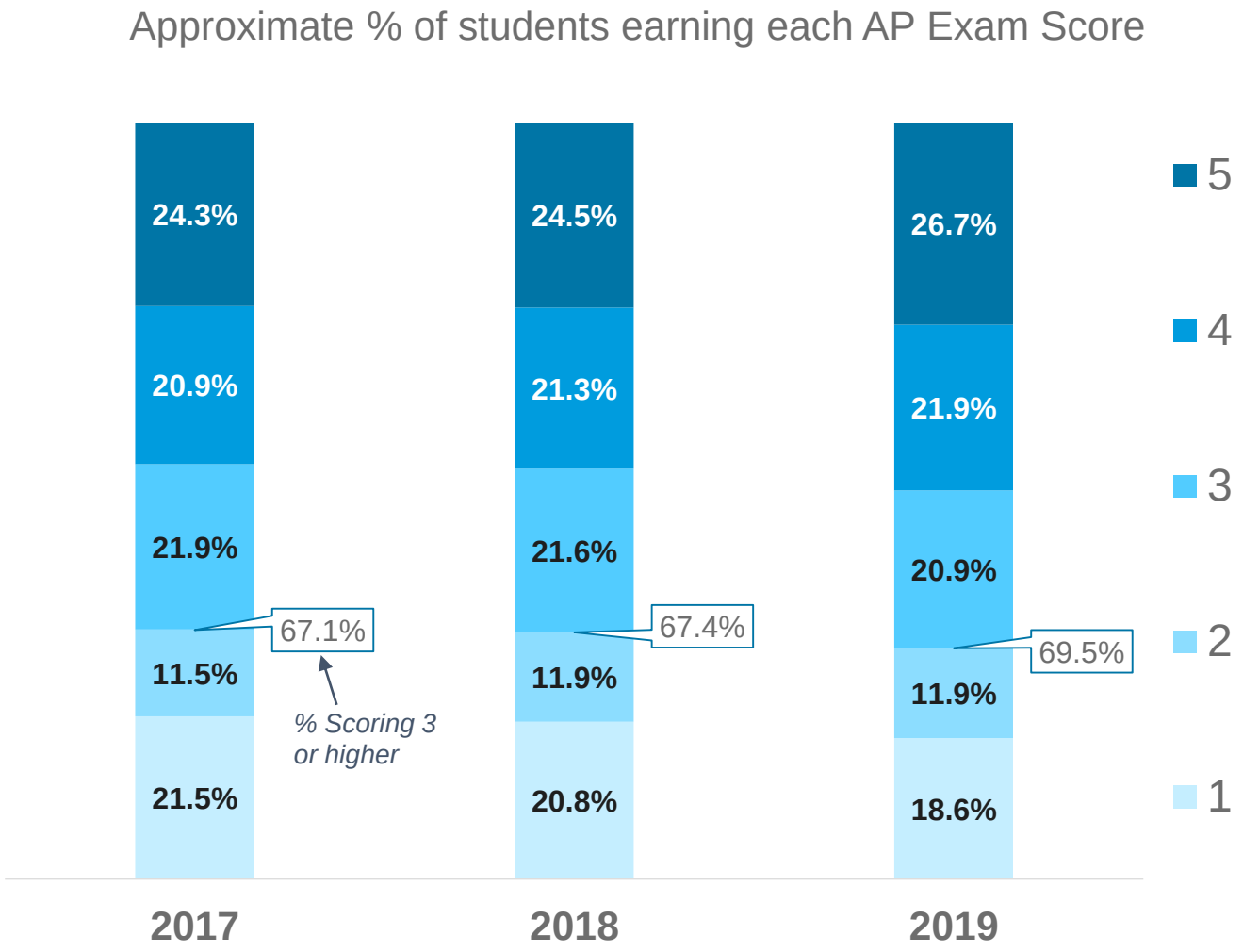
AP Computer Science A Exam Score Distributions (2017-2019)

Observations:
Compared to the last two years, 2019 students earned:

- *more 4s and 5s*
- *about same # of 2s*
- *fewer 1s*



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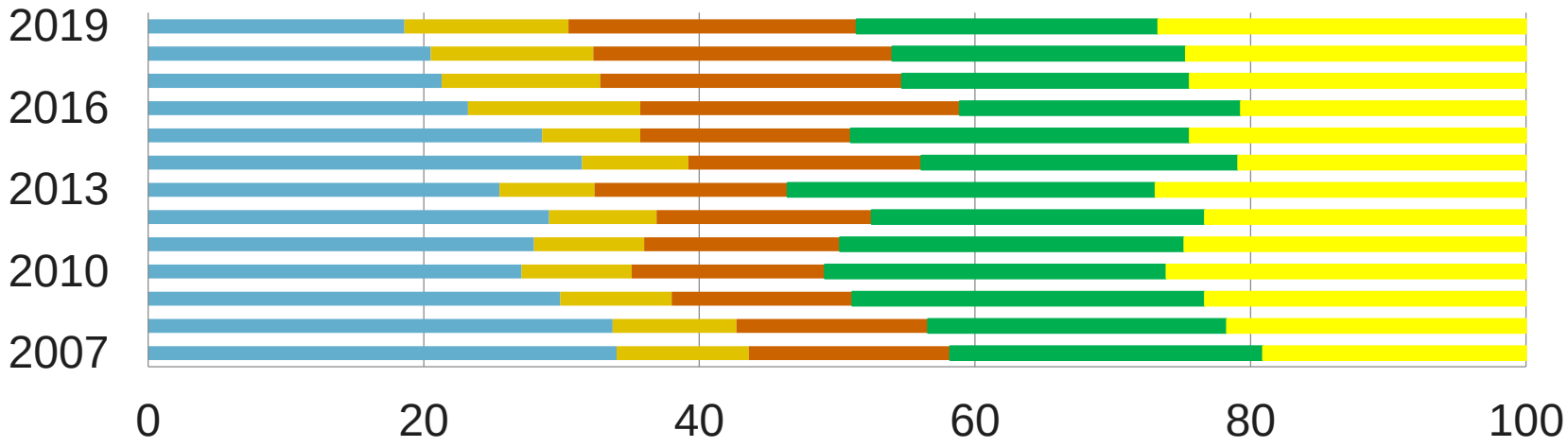
AP Computer Science A Exam Score Distributions (2007-2019)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	34	33.7	29.9	27.1	28	29.1	25.5	31.5	28.6	23.2	21.3	20.5	18.6
2	9.6	9	8.1	8	8	7.8	6.9	7.7	7.1	12.5	11.5	11.8	11.9
3	14.6	13.9	13.1	14	14.2	15.6	14	16.9	15.3	23.2	21.9	21.7	20.9
4	22.7	21.7	25.6	24.8	25	24.2	26.7	23	24.6	20.4	20.9	21.3	21.9
5	19.1	21.7	23.3	26.1	24.8	23.3	26.9	20.9	24.4	20.7	24.4	24.7	26.7

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AP Computer Science A: Mean Student Scores in 2019

	Mean Score (% of Total Possible)
Multiple Choice (MCQ) ***(All students)***	67.48%
Free-Response (FRQ)	59.68%

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AP Computer Science A:

Student Performance on FRQs

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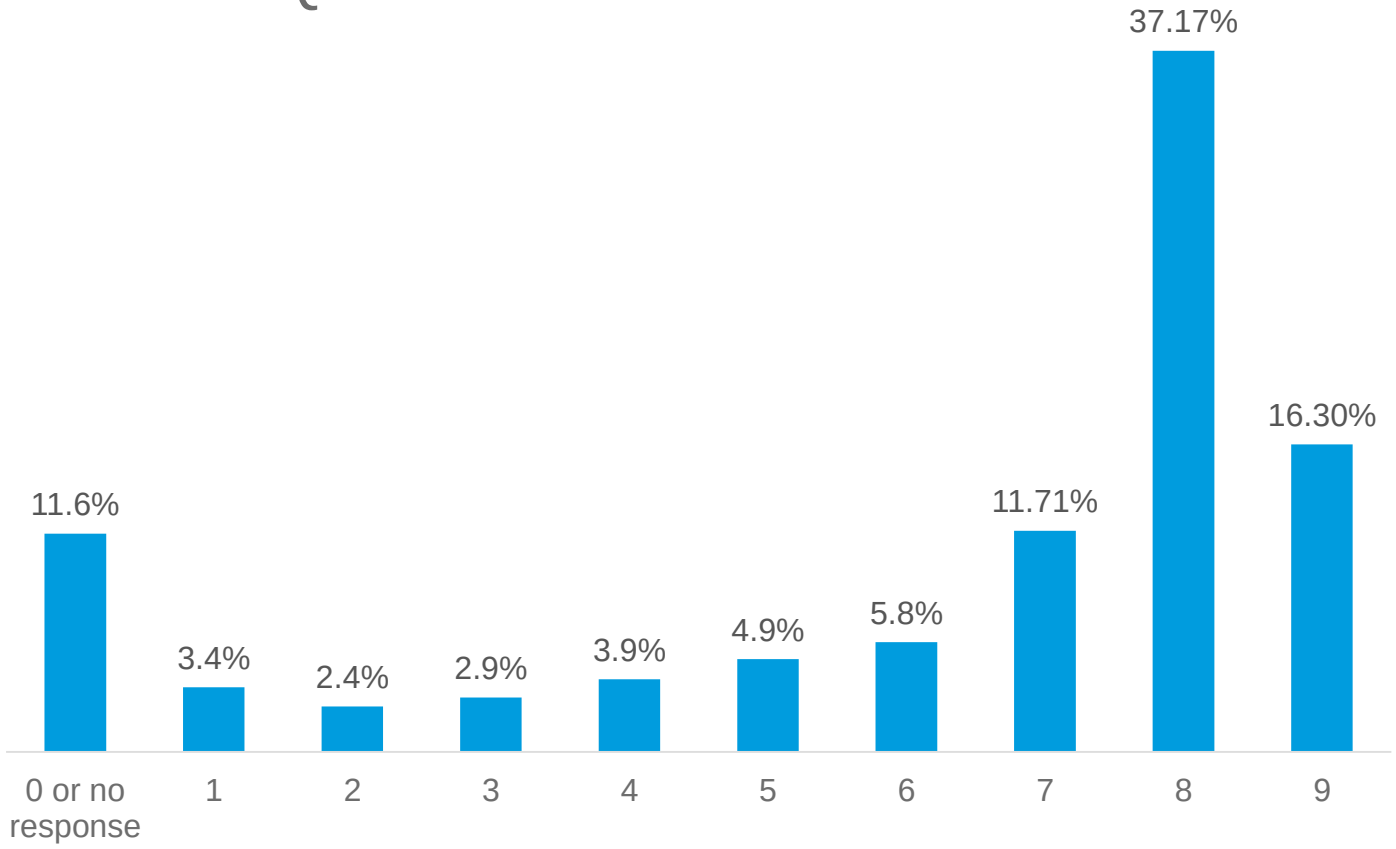
Summary of student performance on FRQs

	Mean Score Out of 9 Possible
FRQ 1 (Leap Year)	6.18
FRQ 2 (Step Tracker)	4.9
FRQ 3 (Delimiters)	5.56
FRQ 4 (Light Board)	4.82

FRQ 1: Score Distributions



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FRQ 1: Student Performance

Part (a)

```
public static int numberOfLeapYears(int year1, int
year2)
{
   int count = 0;
   for (int y = year1; y <= year2; y++)
      if (isLeapYear(y))
         count++;
   return count;
}
```

Part (b)

```
public static int dayOfWeek(int month, int day, int
year)
{
   int startDay = firstDayOfYear(year);
   int nthDay = dayOfYear(month, day, year);
   int returnDay = (startDay + nthDay - 1) % 7;
   return returnDay;
}
```

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Student strengths

1. Calling static methods
2. Looping through a specified range
3. Conditionally incrementing a counter
4. Returning a result

Common errors/misconceptions:

1. Not including upper bound of range
2. Off by one calculation
3. Not limiting a result to the range 0-6
4. Implementing their own algorithm for determining a leap year

FRQ 1: Improving Student Performance

- *Write program code to create objects of a class or call methods.*
  - Assign problems requiring students to invoke static methods.
  - Assign programs requiring students to write static methods.
  - Assign problems requiring students to invoke methods that they didn't implement.

- *Write program code to satisfy methods using expressions, conditional statements, and iterative statements.*
  - Assign problems that require a loop to start at some integer besides 0
  - Assign problems that require inclusion/exclusion of the specified boundary conditions
  - Assign problems that require constraining values to a certain range, like minutes in an hour or hours in a day.
  - Assign problems that require a return when an item is found in sequential search
  - Assign problems that require a return when an item is not present or not found during a search
  - Assign problems that require initializing an empty String to some other default value

AP Computer Science A:

General Advice to Teachers

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Recommendations

- Discuss/practice test-taking skills

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Test taking skills

- Read the question
- 

- Clearly indicate answer on page
~~cross out unwanted code~~
- Eschew obfuscation
- Use reference material
- Read part (b) even if unable to do part (a)
- Test solution using examples
- Use top-down design
especially when time is short
- Preconditions are your friends
- Read the question

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Recommendations

- Discuss/practice test-taking skills
- Address the common errors

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Common Errors

- Failure to read question closely
- Use of new object without construction
- Confusion of == and equals
- Confusion between ArrayLists and arrays
- Accessing too many/few elements in array/list
- Failure to test for and handle boundary cases
- Confusion as to how and when to return values
- Confusion between local and instance variables
- Failure to understand the problem abstraction
- Reimplementation of helper functions
- Use of enhanced for loop when not appropriate

Recommendations

- Discuss/practice test-taking skills
- Address the common errors
- Use material from the reading

Available Material

- http://apcentral.collegeboard.com
- Released free response questions
- Scoring guidelines
- Chief Reader Report (question intent, common errors, recommendations to teachers)
- Sample responses and commentary
- NEW formative questions
  - Personal Progress Checks
  - Topic Questions
- Teacher community on AP Central
- College Board workshops/summer institutes
- Curriculum Framework
- AP Labs
- Facebook group (unofficial)
- https://www.facebook.com/groups/APComputerScienceTeachers/

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Recommendations

- Discuss/practice test-taking skills
- Address the common errors
- Use material from the reading
- Become a reader

AP Computer Science A:

Becoming a Reader

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Why should I consider becoming an AP reader?

AP readers often refer to the AP Reading as one of the best professional experiences they have ever had

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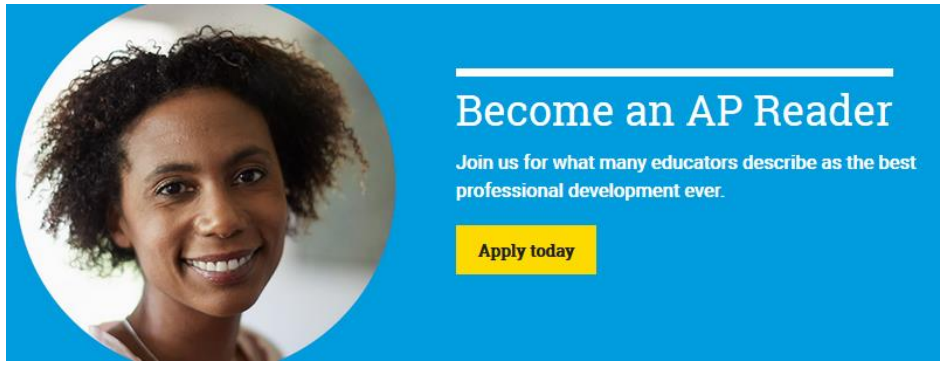
Some reasons to consider becoming an AP reader

- **AP readers enjoy the experience**—98% of educators responding to our AP reader survey in 2018 say they had a positive experience. AP teachers and college faculty enjoy coming together to exchange ideas and experiences.
- **Experiencing the AP Reading leads to positive changes in the classroom**—97% of high school AP teachers and 72% of college faculty who have attended more than one Reading and responded to our 2018 survey indicated that they have actually made changes to the way they teach based upon their participation at the Reading.
- **AP readers learn to apply rubrics with fidelity**—All AP readers are mentored by teams of experienced Reading leaders to effectively and consistently apply scores to responses using a rubric. This includes the usage of benchmark samples and scoring guidelines selected and agreed upon by the Reading leaders for a particular subject.
- **AP readers gain exposure to the full universe of student responses**—AP readers gain valuable insight into the quality and depth of student responses from the entire pool of AP Exam takers, instead of only being exposed to student work from a single class or single school.
- **AP readers are compensated for their effort**—All AP readers are compensated for the work they do, including time spent training. AP readers traveling to a Reading site have their travel expenses covered, including lodging. Meals, snacks, and drinks are also provided to readers scoring at a Reading site.
- **AP readers can earn Continuing Education Units (CEUs) and Professional Development Hours (PDHs)**—These may be applied to professional development requirements required by states, districts, and schools.

Become an AP Reader



To learn more and apply visit: collegeboard.org/apreading

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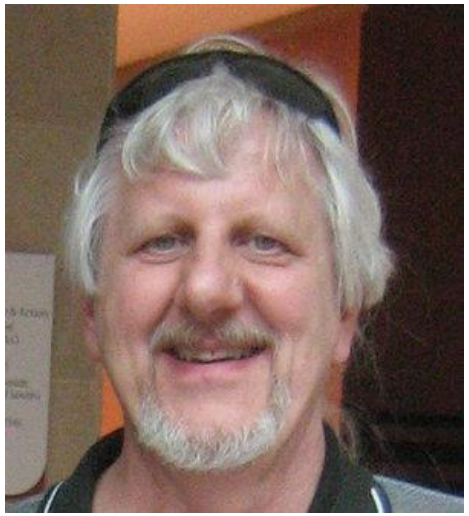
Who can score AP exams?

- Current AP teachers with at least two years of experience teaching their subject (except for CSP, Seminar, Research)
- Active college faculty that have taught one semester of a comparable AP course in the past three years

When to apply to be an AP reader

- There is no official cutoff to submit an application, but…
- Apply as soon as possible because it can take several weeks to get through the application and onboarding process
- Invitations to the 2020 Reading will start going out in January 2020
- If your application is accepted, you are hired into the reader pool and eligible to be invited to future AP Readings (no need to reapply each year)
- We do our best to expose as many educators as possible to the Reading, but some subjects have deep reader pools so it may take time to receive an invitation

Questions?



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