Advanced Placement Computer Science: Meet the Committee

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APCS Development Committee

- Don Allen, Troy High School, California
- Cay Horstmann, San Jose State University, California
- Tracy Ishman, Plano West Senior High, Texas
- Ann Shen, Bishop Strachan School, Ontario
- Fran Trees, Drew University, New Jersey
- Paul Tymann, Rochester Institute of Technology, New York
- Laurie White, Mercer University, Georgia (Chair)

- Jody Paul, Metropolitan State College of Denver (Chief Reader Designate)
- David Reed, Creighton University, Nebraska (Chief Reader)
- Frances Hunt and Dennis Ommert (ETS Test Development)

Retired in 2007:

- Scot Drysdale, Dartmouth College, New Hampshire (Chair)

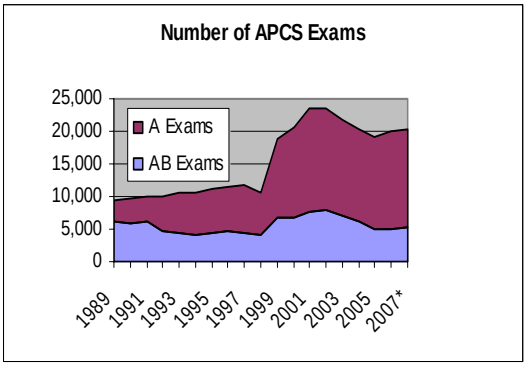
APCS Exam Count

2007* (preliminary data):

15,197 A
5,163 AB
20,360 exams

increase from 2006:

14,814 A
5,058 AB
19,872 exams



Free Response questions were graded during 1 week in Ewing, NJ

169 readers (3 Exam Leaders, 17 Question Leaders, 20 Table Leaders, 129 Readers)
55% college vs. 45% high school readers

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Life at the APCS Reading

apply online at:
www.ets.org/reader/ap

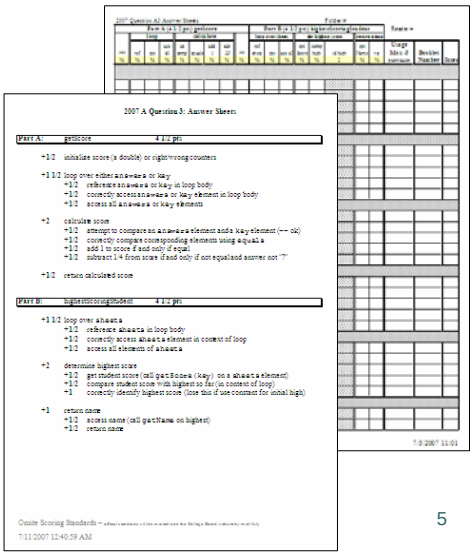
starting in 2008, the reading will be in Louisville, KY

Reading Process

- the Chief Reader develops the initial scoring rubrics
- Question Leaders refine the rubrics & train the readers
- Table Leaders mentor readers and help in applying the rubric

- a variety of consistency checks are built into the process to provide support for readers
  - training packs, split packs, buddy system, backreading, reader stats, reliability studies

CS is one of the top AP subjects in terms of reader reliability and consistency



Grading Issues with Java

all questions are designed with the APCS Java subset in mind

- however, solutions that utilize constructs/classes outside the subset are NOT penalized (unless the question specifically forbids it)

as in previous years, some minor errors are ignored when grading

e.g., missing semicolons, = instead of == , case discrepancies

e.g., no penalty if fail to downcast when accessing a collection

```
Location loc = env.neighborsOf(curr).get(0);
```

instead of

```
Location loc = (Location)(env.neighborsOf(curr).get(0));
```

TEACHERS: ADVISE STUDENTS TO STAY WITHIN THE SUBSET!

2007 Free Response Questions

A1: Self Divisor
- devise and implement an algorithm for identifying and collecting self-divising numbers

A2: Pounce Fish (MBS)
- extend the Fish class to allow for pouncing ahead and eating a fish within a range

A3: Answer Sheets
- utilize existing classes to process and score ArrayLists of multiple choice tests

A4: Game Design (Design)
- utilize existing classes and inheritance to implement an abstract game framework

AB1: Sliding Puzzle (Design)
- implement a specified algorithm for filling a 2-D array, and search for a pattern

AB2: Pair Matcher
- utilize existing classes and a complex Map structure for selecting optimal pairs

AB3: Tree Ball
- construct a full binary tree with random data values, and find a maximum path sum

AB4: Environment Iterator (MBS)
- create and use an iterator to traverse an environment following a diagonal pattern

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Comparison with Recent Exams

subjective view, based on statistical equators and reader experience:

- A and AB exams were comparable to 2006 exams in difficulty
- student performance was slightly weaker at the top on A; comparable on AB

Grade	APCS A Exams				APCS AB Exams			
	2004	2005	2006	2007*	2004	2005	2006	2007*
5 (Extremely well qualified)	18.6%	17.7%	21.8%	19.1%	27.1%	31.0%	33.9%	33.3%
4 (Well qualified)	23.6%	23.1%	22.1%	22.7%	18.2%	19.6%	19.8%	19.7%
3 (Qualified)	15.2%	15.0%	14.4%	14.6%	17.6%	18.2%	17.0%	18.0%
2 (Possibly qualified)	9.5%	10.0%	7.7%	9.6%	12.1%	10.3%	8.8%	9.2%
1 (No recommendation)	33.1%	34.2%	34.0%	34.0%	25.0%	20.9%	20.5%	19.8%

*2007 data is preliminary

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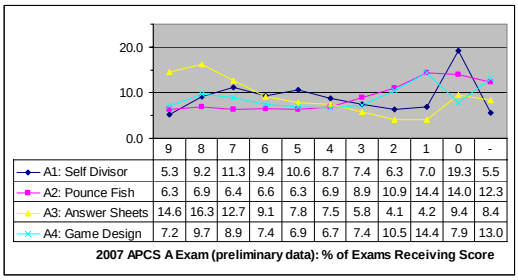
Raw Scoring Data

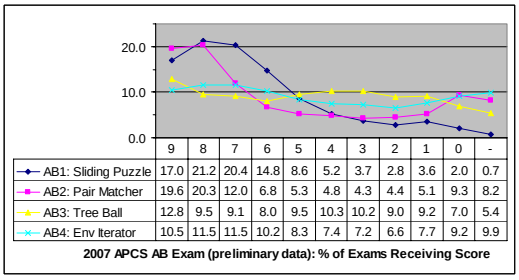


	9	8	7	6	5	4	3	2	1	0	-
A1: Self Divisor	5.3	9.2	11.3	9.4	10.6	8.7	7.4	6.3	7.0	19.3	5.5
A2: Pounce Fish	6.3	6.9	6.4	6.6	6.3	6.9	8.9	10.9	14.4	14.0	12.3
A3: Answer Sheets	14.6	16.3	12.7	9.1	7.8	7.5	5.8	4.1	4.2	9.4	8.4
A4: Game Design	7.2	9.7	8.9	7.4	6.9	6.7	7.4	10.5	14.4	7.9	13.0

2007 APCS A Exam (preliminary data): % of Exams Receiving Score

	mean score*	% of 0/-	mean w/o 0/-
A1	3.86	24.8%	5.13
A2	3.19	26.3%	4.33
A3	5.04	17.8%	6.14
A4	3.68	21.0%	4.66

nice distributions, A3 easiest
still lots of 0's and blanks



	9	8	7	6	5	4	3	2	1	0	-
AB1: Sliding Puzzle	17.0	21.2	20.4	14.8	8.6	5.2	3.7	2.8	3.6	2.0	0.7
AB2: Pair Matcher	19.6	20.3	12.0	6.8	5.3	4.8	4.3	4.4	5.1	9.3	8.2
AB3: Tree Ball	12.8	9.5	9.1	8.0	9.5	10.3	10.2	9.0	9.2	7.0	5.4
AB4: Env Iterator	10.5	11.5	11.5	10.2	8.3	7.4	7.2	6.6	7.7	9.2	9.9

2007 APCS AB Exam (preliminary data): % of Exams Receiving Score

	mean score*	% of 0/-	mean w/o 0/-
AB1	6.38	2.7%	6.56
AB2	5.36	17.4%	6.49
AB3	4.50	12.4%	5.13
AB4	4.42	19.0%	5.46

AB1 and AB2 skewed high,
otherwise nice distributions

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OOP & Problem Solving

with Java, object-oriented techniques are emphasized

- all problems utilized class design and/or implementation, class/method use
- A2, A4, AB2, AB4 utilized inheritance and/or interfaces

students did reasonably well, with some confusion on OOP concepts

- common error: not recognizing when inherited data/methods could be used
- common error: attempting to instantiate an interface directly
- common error: incorrectly utilizing methods of a black-box class

algorithmic problem-solving is tested in various ways

- A1 described a general problem, allowed for many algorithmic approaches
  students could (and did) choose the approach that was natural to them
- A4, AB1, AB4 provided algorithm descriptions, required implementation choices
  students did fairly well, showing the ability to understand and implement algorithms

TEACHERS: CONTINUE TO EMPHASIZE OOP, ABSTRACTION, AND ALGORITHMIC THINKING

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Java Collections

Collection classes are used extensively

- A1: array
- A2: MBS classes
- A3: ArrayList
- A4: ArrayList
- AB1: 2-D array, ArrayList
- AB2: array, List, Map, PriorityQueue
- AB3: binary tree (TreeNode)
- AB4: MBS classes, Iterator, List

students seemed fairly comfortable with Collection classes

- common error: confused access on arrays and ArrayLists
- common error: incorrect creation or access of generic collection classes

A4, AB1, AB3 all involved generating random values

- variety of approaches used: `Math.random`, `Random`, `RandNumGenerator`
- for 2008, `Random` & `RandNumGenerator` are no longer in APCS Java subset
  students should be comfortable using `Math.random` to generate random values

TEACHERS: CONTINUE TO EMPHASIZE COLLECTION USE/ACCESS

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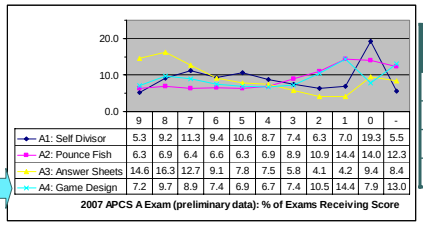
Design Questions

each exam included questions involving "design"

- A4 involved designing and implementing a class extension
- AB1 involved analyzing two alternative implementations of an algorithm



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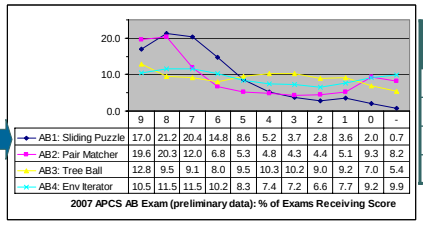

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TEACHERS: CONTINUE TO EMPHASIZE "DESIGN" SKILLS, BOTH CLASS DESIGN & DATA STRUCTURE DESIGN/ANALYSIS

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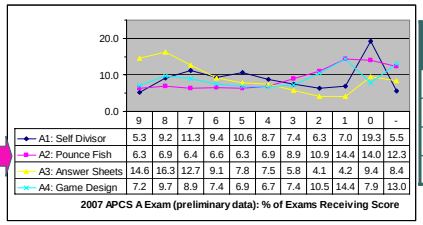
MBS Case Study

student performance on MBS questions was weak

- A2 and AB4 had lowest means, most 0's and blanks
- if 0's and blanks ignored, the means were reasonable (AB4 higher than AB3)



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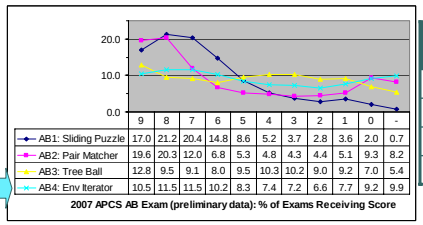

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TEACHERS: THE 2008 EXAM USES THE NEW GRIDWORLD CASE STUDY

MAKE SURE YOUR STUDENTS KNOW IT!

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2007 Exam in Summary

- exam count was up
- A student performance was slightly weaker than 2006
- AB student performance was comparable to 2006
- OOP concepts: good, but some confusion (esp. inheritance & using a black-box class)
- Collections: good, but some confusion (esp. generics & random value generation)
- "Design" skills: excellent
- MBS case study: still unfamiliar to many students, especially A

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FYI: Online Resources

- http://apcentral.collegeboard.com
  AP Central: AP info, course descriptions, reference materials, …
- http://www.collegeboard.com
  College Board: general info about the organization, AP program
- http://www.dave-reed.com/APCS
  unofficial APCS site, includes recent AP-related talks
- http://cs.colgate.edu/APCS
  unofficial APCS site by Chris Nevison (former Chief Reader)

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