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AP

数理统计 (第9版)

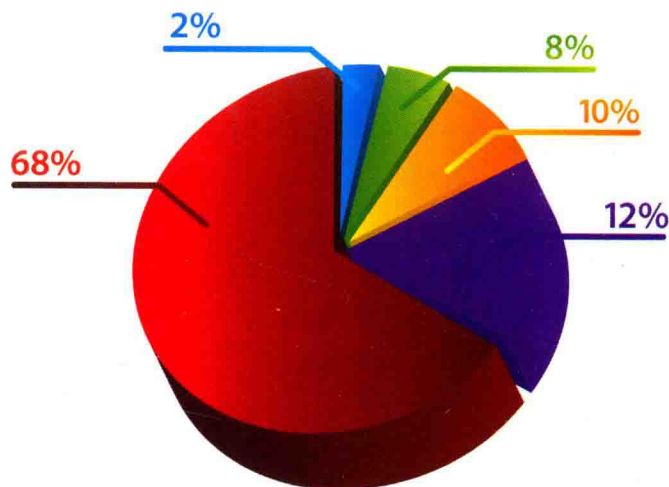
Barron's AP
Statistics (9th edition)

[美] 马丁·施泰恩施泰因 (Martin Sternstein Ph.D.) 编著

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As you review the content in this book and work toward earning that **5** on your AP STATISTICS exam, here are five things that you **MUST** know:

1

Graders want to give you credit—help them! Make them understand *what* you are doing, *why* you are doing it, and *how* you are doing it. Don't make the reader guess at what you are doing.

- **Communication** is just as important as statistical knowledge!
- Be sure you understand **exactly what you are being asked to do or find or explain**.
- *Naked or bald answers* will receive little or **no** credit! You must show where answers come from.
- On the other hand, don't give more than one solution to the same problem—you will receive credit only for the weaker one.

2

Random sampling and random assignment are different ideas!

- Random sampling is the use of chance in selecting a sample from a population and is critical in being able to generalize from a sample to a population.
 - A *simple random sample* (SRS) is when every possible sample of a given size has the same chance of being selected.
 - A *stratified random sample* is when the population is divided into homogeneous units called strata, and random samples are chosen from each strata.
 - A *cluster sample* is when the population is divided into heterogeneous units called clusters, and a random sample of the clusters is chosen.
- Random assignment in experiments is when subjects are randomly assigned to treatments.
 - This randomization evens out effects over which we have no control and allows for a valid comparison of treatments.
 - *Randomized block design* refers to when the randomization occurs only within groups of similar experimental units called blocks.

3

Distributions describe variability! Understand the difference between:

- a *population distribution* (variability in an entire population),
- a *sample distribution* (variability within a particular sample), and
- a *sampling distribution* (variability between samples).
- The larger the sample size, the more the **sample distribution** looks like the population distribution.
- Central Limit Theorem: the larger the sample size, the more the **sampling distribution** (probability distribution of the sample means) looks like a normal distribution.

4

Check assumptions!

- Be sure the assumptions to be checked are stated correctly, but **don't just state them!**
- Verifying assumptions and conditions means more than simply listing them with little check marks—you must show work or give some reason to confirm verification.
- If you refer to a graph, whether it is a histogram, boxplot, stemplot, scatterplot, residuals plot, normal probability plot, or some other kind of graph, you should **roughly draw it**. It is not enough to simply say, "I did a normal probability plot of the residuals on my calculator and it looked linear."

5

Calculating the *P*-value is not the final step of a hypothesis test!

- There must be a *decision* to reject or fail to reject the null hypothesis.
- You must indicate how you interpret the *P*-value, that is, you need *linkage*. So, "Given that $P = 0.007$, I reject ..." isn't enough. You need something like, "Because $P = 0.007$ is less than 0.05, there is sufficient evidence to reject ..."
- Finally, you need a conclusion *in the context* of the problem.

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Introduction 绪论

TIn 1997, 7,667 students took the AP Statistics exam, and as enrollment in AP Statistics classes increased at a higher rate than in any other AP class, more than 208,000 students took the exam in 2016. The number of students required to take statistics in college has surpassed the number of students required to take calculus. High schools across the country have recognized this trend and are developing and expanding their statistics offerings. The new Common Core mathematics standards feature statistics and probability in a primary role throughout the high school curriculum. This Barron's book is intended both as a topical review during the year and for final review in the weeks before the AP exam. Step-by-step solutions with detailed explanations are provided for the many illustrative examples and practice problems as well as for the six practice tests, including a diagnostic test.

The contents of this book cover the topics recommended by the AP Statistics Development Committee. A review of each of 13 topics is followed by multiple-choice and free-response questions on that topic. Detailed explanations are provided for all answers. It should be noted that some of the topic questions are not typical AP exam questions but rather are intended to help review the topic. There is a diagnostic exam, and there are five full-length practice exams, totaling 276 questions, all with instructive, complete answers. An optional disk contains two new, full-length exams with 92 more questions.

This ninth edition has two new topics. Topic 14 helps prepare you for free-response Question 6, the last question on the exam, also called the *Investigative Task*. The purpose of this question is to test your ability to take what you've learned throughout the course and apply that knowledge in a novel way. Topic 15 gives a series of comprehensive review questions covering the whole AP Statistics curriculum and set in a context that aims to give an appreciation of the power of statistics to shed insights into some of society's most pressing issues.

Several points with regard to particular answers should be noted. First, step-by-step calculations using the given tables sometimes give minor differences from calculator answers due to round-off error. Second, calculator packages easily handle degrees of freedom that are not whole numbers, also resulting in minor answer differences. In the above cases, multiple-choice answers in this book have only one reasonable correct answer, and written explanations are necessary when answering free-response questions.

Students taking the AP Statistics Examination will be furnished with a list of formulas (from descriptive statistics, probability, and inferential statistics) and tables (including standard normal probabilities, t -distribution critical values, χ^2 critical values, and random digits). While students will be expected to bring a graphing calculator with statistics capabilities to the examination, answers should not be in terms of calculator syntax. Furthermore, many students have commented that calculator usage was less than they had anticipated.

However, even though the calculator is simply a tool, to be used sparingly, as needed, students should be proficient with this technology.

The examination will consist of two parts: a 90-minute section with 40 multiple-choice problems and a 90-minute free-response section with five open-ended questions and an investigative task to complete. In grading, the two sections of the exam will be given equal weight. Students have remarked that the first section involves “lots of reading,” while the second section involves “lots of writing.” The percentage of questions from each content area is approximately 25% data analysis, 15% experimental design, 25% probability, and 35% inference. Questions in both sections may involve reading generic computer output.

Note that in the multiple-choice section the questions are much more conceptual than computational, and thus use of the calculator is minimal. The score on the multiple-choice section is based on the number of correct answers, with no points deducted for incorrect answers. Blank answers are ignored.

In the free-response section, students must show all their work, and communication skills go hand in hand with statistical knowledge. Methods must be clearly indicated, as the problems will be graded on the correctness of the methods as well as on the accuracy of the results and explanation. That is, the free-response answers should address *why* a particular test was chosen, not just *how* the test is performed. Even if a statistical test is performed on a calculator such as the TI-84, Casio Prizm, or HP Prime, formulas should still be stated. Choice of test, in inference, must include confirmation of underlying assumptions, and answers must be stated in context, not just as numbers.

Free-response questions are scored on a 0 to 4 scale with 1 point for a *minimal* response, 2 points for a *developing* response, 3 points for a *substantial* response, and 4 points for a *complete* response. Individual parts of these questions are scored as E for *essentially* correct, P for *partially* correct, and I for *incorrect*. Note that *essentially* correct does not mean *perfect*. Work is graded *holistically*, that is, a student’s complete response is considered as a whole whenever scores do not fall precisely on an integral value on the 0 to 4 scale.

Each open-ended question counts 15% of the total free-response score and the investigative task counts 25% of the free-response score. The first open-ended question is typically the most straightforward, and after doing this one to build confidence, students might consider looking at the investigative task since it counts more. Each completed AP examination paper will receive a grade based on a 5-point scale, with 5 the highest score and 1 the lowest score. Most colleges and universities accept a grade of 3 or better for credit or advanced placement or both.

While a review book such as this can be extremely useful in helping prepare students for the AP exam (practice problems, practice more problems, and practice even more problems are the three strongest pieces of advice), nothing can substitute for a good high school teacher and a good textbook. This author personally recommends the following texts from among the many excellent books on the market: *Stats: Modeling the World* by Bock, Velleman, and DeVaux; *The Practice of Statistics* by Starnes, Tabor, Yates, and Moore; *Workshop Statistics: Discovery with Data* by Rossman and Chance; *Introduction to Statistics and Data Analysis* by Peck, Olsen, and Devore; and *Statistics: The Art and Science of Learning from Data* by Agresti and Franklin.

Other wonderful sources of information are the College Board’s websites: www.collegeboard.org for students and parents, and www.apcentral.collegeboard.com for teachers.

A good piece of advice is for the student from day one to develop critical practices (like checking assumptions and conditions), to acquire strong technical skills, and to always write clear and thorough, yet to the point, interpretations in context. Final answers to most problems should be not numbers, but rather sentences explaining and analyzing numerical results. To help develop skills and insights to tackle AP free response questions (which often choose contexts students haven't seen before), pick up newspapers and magazines and figure out how to apply what you are learning to better understand articles in print that reference numbers, graphs, and statistical studies.

The student who uses this Barron's review book should study the text and illustrative examples carefully and try to complete the practice problems before referring to the solution keys. Simply reading the detailed explanations to the answers without first striving to work through the problems on one's own is not the best approach. There is an old adage: *Mathematics is not a spectator sport!* Teachers clearly may use this book with a class in many profitable ways. Ideally, each individual topic review, together with practice problems, should be assigned after the topic has been covered in class. The full-length practice exams should be reserved for final review shortly before the AP examination.

ANSWER SHEET

答题纸

Diagnostic Examination

诊断测试

- | | | | |
|---------------|---------------|---------------|---------------|
| 1. A B C D E | 11. A B C D E | 21. A B C D E | 31. A B C D E |
| 2. A B C D E | 12. A B C D E | 22. A B C D E | 32. A B C D E |
| 3. A B C D E | 13. A B C D E | 23. A B C D E | 33. A B C D E |
| 4. A B C D E | 14. A B C D E | 24. A B C D E | 34. A B C D E |
| 5. A B C D E | 15. A B C D E | 25. A B C D E | 35. A B C D E |
| 6. A B C D E | 16. A B C D E | 26. A B C D E | 36. A B C D E |
| 7. A B C D E | 17. A B C D E | 27. A B C D E | 37. A B C D E |
| 8. A B C D E | 18. A B C D E | 28. A B C D E | 38. A B C D E |
| 9. A B C D E | 19. A B C D E | 29. A B C D E | 39. A B C D E |
| 10. A B C D E | 20. A B C D E | 30. A B C D E | 40. A B C D E |