Student Notes: Prep Session Topic: AP Statistics Exam Hints, Writing *Complete* Free Response Answers

Exam Format

The AP Statistics Exam is three hours long. The exam consists of (1) a 90-minute multiple-choice section and (2) a 90-minute free-response section requiring the student to answer open-ended questions and to complete an investigative task involving more extended reasoning. In the determination of the grade for the exam, the two sections will be given equal weight.

In the free-response section of the AP Statistics Exam, students are asked to answer five questions and complete an investigative task. Each question is designed to be answered in approximately 12 minutes. The longer investigative task is designed to be answered in approximately 30 minutes.

You will be allowed to use tables (the same ones that are in your textbook or alternative ones that your teacher will provide), formula sheets, and calculator during the entire exam. Students are not permitted to have programs in their calculators that upgrade the functionality beyond the statistical features found on newer approved models.

Scoring of Free Response Questions

The evaluation of free-response answers reflects the dual importance of statistical knowledge and good communication. The free-response questions and the investigative task are scored "holistically"; that is, each question's response is evaluated as "a complete package." With holistic scoring, after reading through the details of a student's response, the scorer makes a judgment about the *overall quality of the response*.

The AP Statistics scoring guideline (rubric) for each free-response question has five categories, numerically scored on a 0 to 4 scale. Each of these categories represents a level of quality in the student response. The levels of quality are defined on two dimensions: statistical knowledge and communication.

  4: Complete – Shows complete understanding of the problem's statistical components and provides a clear, organized, and complete explanation, using correct terminology, of what was done and why.

  3: Substantial – Shows substantial understanding of the problem's statistical components and provides a clear but not perfectly organized explanation, using correct terminology, of what was done and why, but explanation may be slightly incomplete.

  2: Developing – Shows some understanding of the problem's statistical components and provides some explanation of what was done, but the explanation may be vague and difficult to interpret and terminology may be somewhat inappropriate.

  1: Minimal – Shows limited understanding of the problem's statistical components by failing to identify important components; provides minimal or unclear explanation of what was done or why it was done, and explanation may not match the presented solution.

AP Statistics Exam Scoring

40 Multiple Choice
  Raw Score = total correct (there is NO guessing penalty)
  1.25 * Multiple Choice Raw Score → possible 50 points

5 Free Response
  1.875*Score → possible 7.5 points each → possible 37.5 points

1 Investigative Task
  3.125*Score → possible 12.5 points (note: the investigative task counts 1/8 of the total score – don't skip it!)

Total points possible = 100

Contributions by Gloria Barrett, Virginia Advanced Study Strategies

For the 2007 AP Statistics exam, the score ranges were:

Total Points AP Grade

Score	Points
5	63 to 100
4	49 to 62
3*	37 to 48
2	29 to 36
1	0 to 28

These scores have been revised recently, BUT they are in the ball park

*That is correct… Students only needed 37% of the points to earn a qualifying score in 2007!

General tips for writing free response answers (adapted from Zack Bigner post to the AP Statistics EDG)
1. Understand that your obligation as a test taker is to convince the reader that you understand the key concepts in the question. You are evaluated both on the correctness of your answers and on your ability to communicate the methods you used to reach them.
2. Be aware that "naked" numerical answers receive no credit; similarly, single word answers, for example, "yes" or "no," receive no credit without justification.
3. Calculator syntax will not be sufficient for full credit.
4. Read all the parts of a question and think about how they are related before you begin writing your answer. If one part asks you to answer a question based on the result of a previous part that you could not do, make up an answer to the previous part so that you can continue. Sometimes the later parts of a question do not depend on the parts that come before. Be sure to read every part of a question so that you don't overlook later parts that you can answer.
5. Answer the question that you are asked. Read each question carefully to make sure you really understand what is being asked.
6. When you have answered the question, quit writing. Generally you are given more space than you need.
7. Answer the question in context. This is especially important when writing conclusions.
8. Use standard symbols and be sure to define any symbols that you make up. Be careful not to confuse symbols for population parameters and symbols for sample statistics.
9. Use vocabulary very carefully. Be especially careful when you use the words *normal* and *significant*.
10. Avoid using the pronoun "it" unless the antecedent is clear. You will not get full credit for a vague answer.
11. Leave sufficient time for the investigative task. One strategy is to work several of the other free response questions that seem easy to you and then work on the investigative task for awhile. If you run out of time, it would be better to omit one of the five regular free response questions, since they count less than the Investigative Task.
12. Provide only one answer to a question. When students provide two solutions, AP Statistics readers will grade both solutions and record the lower sore. So you will waste precious time if you work a problem two ways.
13. If you decide to change an answer, be sure to cross out or erase the incorrect answer. Often crossing out the answer is quicker, if you have room for the new answer.
14. On both Multiple Choice and Free Response questions, skip questions that seem hard to you. Come back and work on these questions if time permits. There is no "guessing penalty" – answer _all_ of the multiple-choice questions.
15. Write neatly and clearly.

Reviewing for the exam
You will be preparing for the AP Statistics exam all year, but you will be most successful if you begin a systematic review several weeks before the exam. Your teacher will provide you with the list of topics covered on the exam.

These topics are posted on the College Board web site. See pages 6-10:
http://apcentral.collegeboard.com/apc/public/repository/ap-statistics-course-description.pdf

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Writing complete answers to descriptive statistics questions

1. If you are asked to make a graph, be sure to include a title, labels on the horizontal and vertical axes, and scales on both axes (if appropriate). Also, if the graph includes multiple data sets (for example parallel boxplots), be sure to label each plot.

2. Be careful when you describe the shape of a mound-shaped, approximately symmetric distribution. The distribution may or may not be normal. Graders will accept the description as *approximately normal*, but they will not accept that the distribution *is normal* based only on a mound-shaped, symmetric graph.

3. Be careful to use the correct term when you describe the shape of a *uniform* distribution.

4. If you are asked to provide information about a distribution based on a graph, you should *always* comment on center, shape, and spread. If there are unusual features, for example outliers, clusters, or gaps, you should also comment on those. All discussion should be *in context*.

5. If you are asked to compare two distributions based on graphs, be sure to *compare and describe* the center, shape, and spread. Simply listing these features for both samples without a direct comparison has earned students no credit in the past. Also, saying that shapes are similar without describing the shape will not receive full credit.

6. Right skewed is the same as skewed toward large values; left skewed is the same as skewed toward small values. A student may also describe right-skewedness as "having a longer tail on the right".

7. If a distribution is approximately symmetric, the mean and median will be close in value. If a distribution is skewed, the mean will generally be pulled away from the median in the direction of the tale. So generally it will be correct to say "since the distribution is skewed to the right, we expect the mean to be greater than the median."

8. Knowing that the mean and median are unequal does not guarantee that the shape of the distribution is skewed. So it is risky (and generally not correct) to say something like "since the mean is greater than the median, the distribution is skewed to the right."

Writing complete answers to probability questions

1. Be sure to show support for your answers. For example, on an expected value problem, show the formula $\mu_X = E(X) = \sum x_i p_i$; on a problem requiring probabilities associated with a normal distribution, provide a sketch and a statement of the probability you are calculating.

2. Be sure to identify the model being used for questions requiring a normal distribution along with the appropriate mean, standard deviation and the direction. This can be done via a sketch of the normal distribution with mean and standard deviation labeled and the appropriate portion of the graph shaded.

3. Be sure to identify the model being used for questions requiring a binomial distribution along with the appropriate parameters (n and p) . This can be done by simply stating "the distribution of X follows a binomial distribution with n=___ and p=___. It is also acceptable for students to use the standard notation: $X \sim B(n,p)$.

4. If the answer to one part of a free response question depends on the answer to a previous part that you could not work, make up an answer to the previous part (be sure to state that you are doing this) and use it in your computations. Choose a value between 0 and 1 other than .5.

5. Never leave an answer to a probability problem that is greater than 1 or less than 0.

Additional Reminders…

Use your calculator wisely

Calculators can save you lots of time on both Multiple Choice and Free Response questions. Be sure to review the syntax your calculator uses for

- Computing summary statistics
- Binomial probability computations
- Computations associated with normal, t, and X^2 distributions
- Computing linear regression equations
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Also, be sure that you know how to create statistical graphs, including boxplots, histograms, normal probability plots, scatter plots (with and without regression lines), and residual plots.

You should also be familiar with the confidence intervals and significance tests that your calculator will perform. Entering the two-way table for X^2 tests may require matrices, so be sure to review these procedures before the AP exam.

As stated previously, calculator syntax will not provide sufficient support for numerical answers. Be sure to give additional support for your answer that communicates your understanding of the procedure or computation.

Last minute reminders

1. Get a good night's sleep before the exam.
2. Make sure your calculator has good batteries. You are allowed to bring two calculators to the exam.
3. Bring extra pencils.
4. Do not panic! Keep in mind that it usually takes less than 70 points to get a 5 on the exam and only around 40% to earn a 3.

Tips for Success on the Multiple Choice Section

1. Know your stuff!

2. Answer every question. Your score is based on the number of correct answers you get.

3. Don't spend too much time on a question. If you're not sure, circle the question number and come back to it later.

4. Read each question carefully. Underline/circle key words and phrases. After deciding on an answer choice, glance at the highlighted words and phrases to make sure you haven't made a careless mistake or an incorrect assumption.

5. Think about the purpose of the question. What topic is being tested? What is the purpose of the question?

6. You don't have to answer all of the questions to get a good overall score.

7. If an answer choice seems "obvious," think about it. If it's so obvious to you, it's probably obvious to others, and chances are good that it is not the correct response. For example, suppose one set of test scores has a mean of 80, and another set of scores on the same test has a mean of 90. If the two sets are combined, what is the mean of the combined scores? The "obvious" answer is 85 (and will certainly appear among the answer choices), but you, as an intelligent statistics student, realize that 85 is not necessarily the correct response.

8. If you tend to get fooled by the clever distracters, try this: read the stem of the question and cover up the answer choices. Try to anticipate the form of the correct answer before you start looking at the answer choices.