

Scoring Guidelines for FRQs

(Source: AP Statistics Course description at <https://apstudent.collegeboard.org/apcourse/ap-statistics/course-details>)

Sample Questions for **Statistics**

Free-Response Questions

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.

Statistics is a discipline in which clear and complete communication is an essential skill. The free-response questions on the AP Statistics Exam require students to use their analytical, organizational and communication skills to formulate cogent answers and provide students with an opportunity to:

- Relate two or more different content areas (i.e., exploratory data analysis, experimental design and sampling, probability, and statistical inference) as they formulate a complete response or solution to a statistics or probability problem.
- Demonstrate their mastery of statistics in a response format that permits the students to determine *how* they will organize and present each response.

The purpose of the investigative task is not only to evaluate the student's understanding in several content areas but also to assess his or her ability to integrate statistical ideas and apply them in a new context or in a nonroutine way.

Scoring of Free-Response Questions

The evaluation of student responses on the free-response section of the AP Statistics Exam 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. This is different from “analytic” scoring, where the individual components to be evaluated in a student's response are specified in advance, and each component is given a value counting toward the overall score.

Holistic scoring is well suited for questions where the student is required to synthesize information and respond at least partially in written paragraphs, and for questions that could potentially generate multiple and diverse, but equally correct, responses. For example, an open-ended question may present data from a real-life study and ask the student not only to analyze the data but also to comment on how the study's protocol might be improved. Comments on improving the protocol might focus on improving the sampling method, controlling confounding variables, or seeking more power by increasing the sample size. In this context, holistic scoring represents a recognition not only of the existence of multiple reasonable approaches to a statistical analysis, but a realization of the existence of a statistical synergy — i.e., that a quality student response is more than just the sum of its parts.

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. These levels of quality are defined on two dimensions: statistical knowledge and communication. The specific rubrics for each question are tied to a general template, which represents the descriptions of the quality levels as envisioned by the Development Committee. This general template is given in the following table, “A Guide to Scoring Free-Response Statistics Questions.”

**A GUIDE TO SCORING FREE-RESPONSE STATISTICS QUESTIONS:
THE CATEGORY DESCRIPTORS**

Score Descriptors	Statistical Knowledge	Communication
	Identification of the important components of the problem Demonstration of the statistical concepts and techniques that result in a correct solution of the problem	Explanation of what was done and why, along with a statement of conclusions drawn in context
4 Complete	<ul style="list-style-type: none"> • shows complete understanding of the problem's statistical components • synthesizes a correct relationship among these components, perhaps with novelty and creativity • uses appropriate and correctly executed statistical techniques • may have minor arithmetic errors but answers are still reasonable 	<ul style="list-style-type: none"> • provides a clear, organized, and complete explanation, using correct terminology, of what was done and why • states appropriate assumptions and caveats • uses diagrams or plots when appropriate to aid in describing the solution • states an appropriate and complete conclusion in context

3 Substantial	<ul style="list-style-type: none"> • shows substantial understanding of the problem's statistical components • synthesizes a relationship among these components, perhaps with minor gaps • uses appropriate statistical techniques • may have arithmetic errors but answers are still reasonable 	<ul style="list-style-type: none"> • provides a clear but not perfectly organized explanation, using correct terminology, of what was done and why, but explanation may be slightly incomplete • may miss necessary assumptions or caveats • uses diagrams or plots when appropriate to aid in describing the solution • states a conclusion that follows from the analysis but may be somewhat incomplete
2 Developing	<ul style="list-style-type: none"> • shows some understanding of the problem's statistical components • shows little in the way of a relationship among these components • uses some appropriate statistical techniques but misses or misuses others • may have arithmetic errors that result in unreasonable answers 	<ul style="list-style-type: none"> • provides some explanation of what was done, but explanation may be vague and difficult to interpret and terminology may be somewhat inappropriate • uses diagrams in an incomplete or ineffective way, or diagrams may be missing • states a conclusion that is incomplete
1 Minimal	<ul style="list-style-type: none"> • shows limited understanding of the problem's statistical components by failing to identify important components • shows little ability to organize a solution and may use irrelevant information • misuses or fails to use appropriate statistical techniques • has arithmetic errors that result in unreasonable answers 	<ul style="list-style-type: none"> • provides minimal or unclear explanation of what was done or why it was done, and explanation may not match the presented solution • fails to use diagrams or plots, or uses them incorrectly • states an incorrect conclusion or fails to state a conclusion
0	<ul style="list-style-type: none"> • shows little to no understanding of statistical components 	<ul style="list-style-type: none"> • provides no explanation of a legitimate strategy

Some important points that students should remember when answering free-response questions on the AP Statistics Exam are given below.

1. Read the questions carefully and answer them in context; for example, the results of a hypothesis test should always be followed by a conclusion in context, and a confidence interval should always be followed by an interpretation of the interval in context. Explanations and conclusions in context are always required for a complete answer.
2. Know the vocabulary of statistics, and use that vocabulary correctly in all written responses.
3. Remember to define all symbols. Specifically, remember to distinguish between population parameters and sample statistics.
4. Remember to state and check all necessary assumptions when performing hypothesis tests and constructing interval estimates.
5. Be able to interpret data displayed in a variety of ways, including graphs and computer outputs. Be able to represent data in a variety of forms and base sound statistical arguments on these representations.

AP Central contains free-response questions, scoring guidelines and selected student responses from past AP Statistics Exams. This is an excellent place to become more familiar with the content of past free-response questions and how they were scored.

The following questions are examples of free-response questions. These questions were administered as part of a previous year's exam.

1. The summary statistics for the number of inches of rainfall in Los Angeles for 117 years, beginning in 1877, are shown below.

N	MEAN	MEDIAN	TRMEAN	STDEV	SE MEAN
117	14.941	13.070	14.416	6.747	0.624

MIN	MAX	Q1	Q3
4.850	38.180	9.680	19.250

- (a) Describe a procedure that uses these summary statistics to determine whether there are outliers.
- (b) Are there outliers in these data?
Justify your answer based on the procedure that you described in part (a).
- (c) The news media reported that in a particular year, there were only 10 inches of rainfall. Use the information provided to comment on this reported statement.