AP® CollegeBoard

2020 Exam Sample Question

AP® STATISTICS

Note: This is an example of 2020 Question 2, a multi-focus free-response item with allotted time of 15 minutes (plus 5 minutes to submit).

Question 1 is a longer multi-focus free-response item, with allotted time of 25 minutes (plus 5 minutes to submit).

Question 2

Allotted time: 15 minutes (plus 5 minutes to submit)

Students at an agricultural station conducted a study to compare genetically modified (GM) corn with regular corn. Each of 33 plots of land was divided into two half-plots; one half-plot was randomly selected to be planted with the GM corn, and the other half-plot was planted with the regular corn.

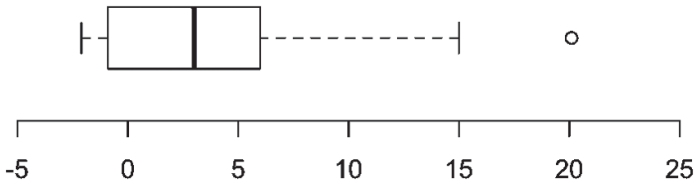
The table shows summary statistics for the yields, in bushels per acre, and the difference in yield (GM minus regular) for each plot.

	Mean	Standard Deviation	*n*	Minimum	Q1	Median	Q3	Maximum
GM	125.018	13.623	33	107.4	111.9	127.5	138.0	144.0
Regular	120.482	10.321	33	102.9	111.0	119.4	129.0	133.5
Difference	4.536	6.444	33	–2.1	–0.9	3.0	6.0	20.1

(a) Explain why the yields from one type of corn are <u>not</u> independent of the yields from the other type of corn.

(b) Based on the summary statistics, would it be more likely to obtain a yield of 123 or more bushels per acre from a plot of GM corn or a plot of regular corn? Justify your answer.

A boxplot of the differences in yield is shown below.



Difference in yield (bushels per acre, GM minus regular)

(c) Describe the distribution of the differences.

The students conducted a test of the hypotheses

$$H_0 : \mu_d = 0$$
$$H_a : \mu_d \neq 0,$$

where μ_d is the population mean difference (GM minus regular) in yield, in bushels per acre, for plots similar to those used in the study. The conditions for inference have been met.

(d) One of the conditions for inference that was met is that the sample size of the differences is greater than 30. Explain why it is necessary to satisfy this condition.

(e) The test resulted in a *p*-value of 0.0003. Based on the *p*-value, what conclusion should the students make?