

AP[®] STATISTICS

2011 SCORING GUIDELINES

Question 2

Intent of Question

The primary goals of this question were to assess students' ability to (1) determine a conditional probability from a table of data; (2) use a table of data to determine whether or not two events are independent; (3) demonstrate an understanding of the concept of independence by constructing a graph that displays independence between two variables.

Solution

Part (a):

Of the 200 male registered voters in Franklin Township, 48 are registered for Party Y. Therefore the conditional probability that a randomly selected voter is registered for Party Y, given that the voter is a male, is $\frac{48}{200} = 0.24$.

Part (b):

No, the events “is a male” and “is registered for Party Y” are not independent. One justification of this conclusion is to note that the conditional probability of the event “is registered for Party Y” given the event “is a male” — which was computed in part (a) — is not equal to the probability of the event “is registered for Party Y,” as shown below.

$$P(\text{is registered for Party Y} \mid \text{is a male}) = 0.24$$

$$P(\text{is registered for Party Y}) = \frac{168}{500} = 0.336$$

Because $0.24 \neq 0.336$, the two events are not independent.

Part (c):

The marginal proportions of voters registered for each of the three political parties (without regard to gender) are given below.

$$\text{Party W: } \frac{88}{500} = 0.176$$

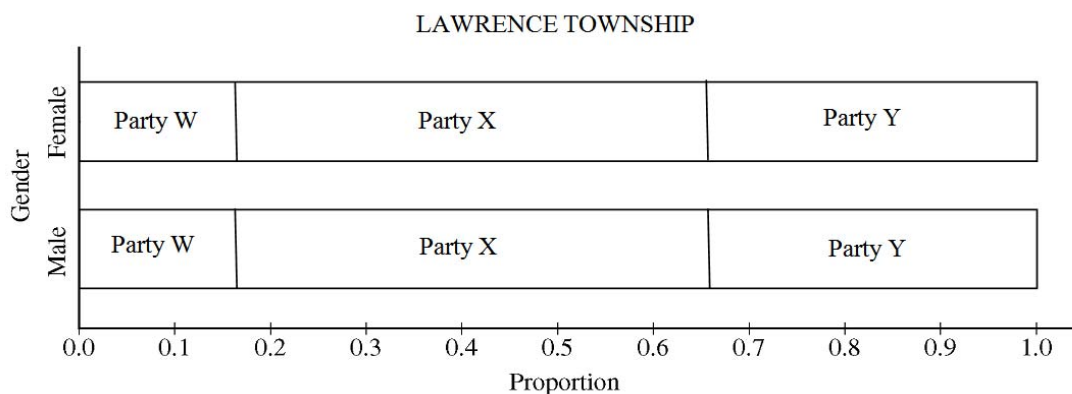
$$\text{Party X: } \frac{244}{500} = 0.488$$

$$\text{Party Y: } \frac{168}{500} = 0.336$$

Because party registration is independent of gender in Lawrence Township, the proportions of males and females registered for each party must be identical to each other and also identical to the marginal proportion of voters registered for that party. Using the order Party W, Party X, and Party Y, the graph for Lawrence Township is displayed below.

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Question 2 (continued)



Scoring

Parts (a), (b) and (c) are scored as essentially correct (E), partially correct (P) or incorrect (I).

Part (a) is scored as follows:

Essentially correct (E) if the response has the correct conditional probability *AND* shows the work.

Partially correct (P) if the response has the correct reverse conditional probability (of being a male given that he is registered for Party Y),

OR

if the response has the correct conditional probability *BUT* does not show work.

Incorrect (I) if the response fails to meet the criteria for E or P.

Part (b) is scored as follows:

Essentially correct (E) if the response identifies two values whose inequality implies a lack of independence between the events *AND* includes the following three components:

1. Correct computations of the two values.
2. An explicit statement of whether the two values are equal or unequal.
3. An appropriate conclusion about the independence of the events.

Partially correct (P) if the response identifies two values whose inequality implies a lack of independence between the events but includes only two of the three components listed above.

Incorrect (I) if the response fails to meet the criteria for E or P.

Part (c) is scored as follows:

Essentially correct (E) if the response shows the same conditional distribution of party registration for both males and females *AND* includes the following two components:

1. Correct proportions for each party.
2. Correct labels (Party W, Party X, Party Y).

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Question 2 (continued)

Partially correct (P) if the response shows the same conditional distribution of party registration for both males and females *AND* includes only one of the two components listed above.

Incorrect (I) if the response fails to meet the criteria for E or P.

Note: For all three parts, an incorrect statement that indicate a serious misunderstanding of statistical concepts, even if unrelated to the rest of the response, lowers the score one level (that is, from E to P, or from P to I). An example of this is a response that indicates confusion between independent events and disjoint events.

4 Complete Response

All three parts essentially correct

3 Substantial Response

Two parts essentially correct and one part partially correct

2 Developing Response

Two parts essentially correct and one part incorrect

OR

One part essentially correct and one or two parts partially correct

OR

Three parts partially correct

1 Minimal Response

One part essentially correct and two parts incorrect

OR

Two parts partially correct and one part incorrect