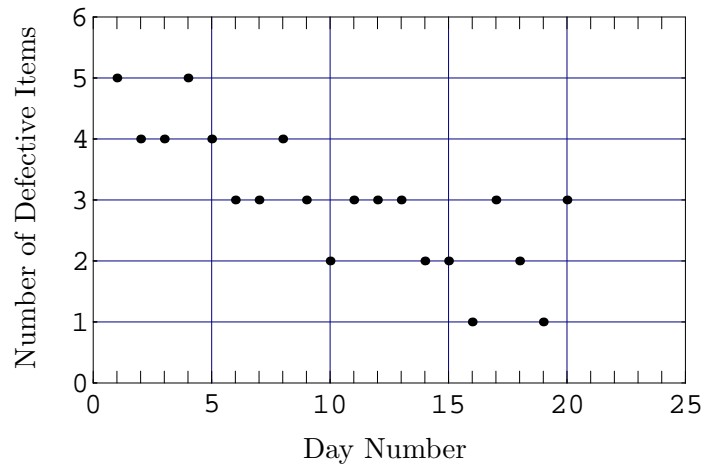


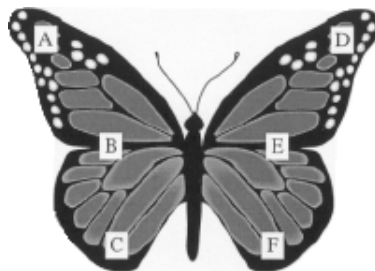
2. A plot of the number of defective items produced during 20 consecutive days at a factory is shown below.



- (a) Draw a histogram that shows the frequencies of the number of defective items.
(b) Give one fact that is obvious from the histogram but is not obvious from the scatterplot.
(c) Give one fact that is obvious from the scatterplot but is not obvious from the histogram.
-

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3. Researchers often mark wildlife in order to identify particular individuals across time or space. A study of butterfly migration is designed to determine which location on the butterflies' wings is best for marking. The six possible locations are those shown as A through F in the figure below. The butterfly in the figure is a monarch (*Danaus plexippus*).



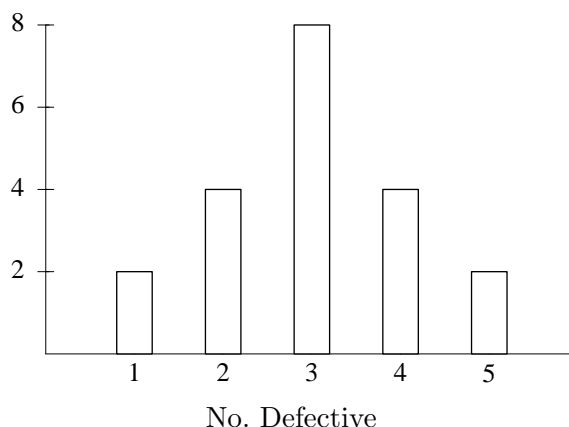
Because marks in certain locations may be more likely to attract predators or cause problems than marks in other locations, the goal is to determine whether the six marking locations result in equivalent chances of successful migration. To test this, researchers plan to mark 3,600 butterflies and release them, then count how many arrive displaying each marking location at the end of the migratory path.

- (a) Briefly describe a method you could use to assign the marking locations if you wanted to ensure that exactly 600 butterflies were marked in each location.
 - (b) Briefly describe a method you could use to assign the marking locations if you wanted to be independent from one butterfly to the next, and wanted each location assigned with a probability $1/6$ each time.
 - (c) Using your method of assignment from part (b), explain how you would analyze the data collected from this study.
 - (d) If butterflies are marked using your method of assignment from part (a), would you change your method of analysis? Explain your reasoning.
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Free-Response Scoring Guidelines: Question 2**4 Complete Response**

- (a) Shows a correct histogram (or bar graph) of the number of defective items produced per day, as shown below. The vertical scale could be either frequency or relative frequency ($8/20 = .40$).



- (b) The most obvious fact from the histogram is that the number of defective items has a symmetric, mound-shaped, bell-shaped or approximately normal distribution. Any one of these terms (or phrases that convey the same notion) will be considered as correct. The term normal distribution is not acceptable for a complete response.

Other facts that might be reported include the mean of 3 and/or some measure of spread, such as the standard deviation of approximately 1.1, but numerical summaries are not required, whereas some statement on shape is required.

- (c) The most obvious fact from the scatterplot is that the number of defects per day has a decreasing, linear trend across the days. This point should not be missed even if other correct information, such as the larger spread for the later days, is given. Statements such as negative correlation, negative association and negative slope are acceptable as correct answers here.

3 Substantial Response

- (a) Draws a histogram that is essentially correct, but may have a minor error such as an error in counting or scaling.
- (b) Makes a nearly correct statement about the shape of the histogram. Stating that the number of defects is normally distributed without qualification will reduce the score to a maximum of 3.
- (c) Makes a correct, but perhaps weak or incomplete, statement on the decreasing trend over time in the scatterplot.

2 Developing Response

Draws a histogram nearly correctly and has a nearly correct description of the shape of the histogram. (The term normal distribution is acceptable here.) Makes no correct statement about essential features of the scatterplot.

OR

Draws a histogram incorrectly but then makes correct statements based on that drawing. Makes a

correct statement about a feature of the scatterplot that reflects some understanding of the graphical image portrayed.

OR

Draws a histogram nearly correctly but interprets it incorrectly. Makes a correct statement about a feature of the scatterplot that reflects some understanding of the graphical image portrayed.

1 Minimal Response

Has a partially correct response in at least one the three parts.
