

Case Study 2: Analyzing Friendships in a Classroom

In a class of 12th-grade students, the teacher wants to examine the friendship patterns among the students to understand social dynamics. Let the set of boys in the class be $B = \{b_1, b_2, b_3\}$ and the set of girls be $G = \{g_1, g_2, g_3, g_4\}$. A relation F is defined from B to G , where (b_i, g_j) means boy b_i considers girl g_j as a friend. The relation is given by the set $\{(b_1, g_1), (b_1, g_2), (b_2, g_2), (b_2, g_3), (b_3, g_4)\}$. Based on this, answer the following multiple-choice questions:

1. What is the domain of the relation F ?

- (a) $\{b_1, b_2, b_3\}$
- (b) $\{g_1, g_2, g_3, g_4\}$
- (c) $\{b_1, b_2\}$
- (d) $\{b_1, b_2, b_3, g_1, g_2, g_3, g_4\}$

Answer: (a) $\{b_1, b_2, b_3\}$

Solution: The domain of the relation is the set of first elements (boys) in each pair.

2. What is the range of the relation F ?

- (a) $\{b_1, b_2, b_3\}$
- (b) $\{g_1, g_2, g_3, g_4\}$
- (c) $\{g_1, g_2, g_3\}$
- (d) $\{b_1, g_1, g_2, g_3, g_4\}$

Answer: (c) $\{g_1, g_2, g_3\}$

Solution: The range is the set of second elements (girls) in the ordered pairs.

3. Determine the codomain of the relation F .

- (a) $\{b_1, b_2, b_3\}$
- (b) $\{g_1, g_2, g_3, g_4\}$
- (c) $\{g_1, g_2, g_3\}$
- (d) $\{b_1, b_2, b_3, g_1, g_2, g_3, g_4\}$

Answer: (b) $\{g_1, g_2, g_3, g_4\}$

Solution: The codomain is the set of girls since F is defined from boys to girls.

4. How many elements does the relation F have?

- (a) 4
- (b) 5
- (c) 6
- (d) 3

Answer: (b) 5

Solution: The relation consists of 5 ordered pairs.

5. Is the relation F a function from B to G ?

- (a) Yes
- (b) No

- (c) Cannot be determined
- (d) Only if B has more elements

Answer: (b) No

Solution: For F to be a function, each element of the domain B must be paired with exactly one element in G . Here, b_1 and b_2 are each paired with two different girls, so F is not a function.

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