

**Additional Relations Problems
for Janet Vassilev's Math 327 course**

1. Let $A = \{a, b, c, d, e\}$. Define a relation R on A via the following table:

| R | a | b | c | d | e |
|---|---|---|---|---|---|
| a | x | x | | | |
| b | x | x | | | |
| c | | | x | | |
| d | | | | x | x |
| e | | | | x | x |

Determine if R is reflexive, symmetric, antisymmetric or transitive.

2. Let $A = \{a, b, c, d, e\}$. Define a relation R on A via the following table:

| R | a | b | c | d | e |
|---|---|---|---|---|---|
| a | | x | x | x | x |
| b | | | x | x | x |
| c | | | | x | x |
| d | | | | | x |
| e | | | | | x |

Determine if R is reflexive, symmetric, antisymmetric or transitive.

3. Let $A = \{a, b, c, d, e\}$. Define a relation R on A via the following table:

| R | a | b | c | d | e |
|---|---|---|---|---|---|
| a | x | x | | | |
| b | | x | x | | |
| c | | | x | x | |
| d | | | | x | x |
| e | | | | | x |

Determine if R is reflexive, symmetric, antisymmetric or transitive.

4. Use a table to give examples of relations R on $A = \{a, b, c, d\}$ which satisfy the following properties:

- (a) R is reflexive and transitive but not symmetric nor antisymmetric.
- (b) R is symmetric and transitive but not reflexive.
- (c) R is reflexive and antisymmetric but not transitive.
- (d) R is reflexive and symmetric but not transitive.

5. Give an example of a partial order R on the set $A = \{2, 3, 5, 6\}$ where

- (a) 2 is the smallest element of A .
- (b) 2 and 3 are minimal elements.
- (c) 5 is both a minimal and maximal element.

6. Using the partial order R on $A = \{a, b, c, d, e, f, g\}$ given by the following table answer the following questions:

| R | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| a | x | x | x | | | | |
| b | | x | x | | | | |
| c | | | x | | | | |
| d | | | | x | x | x | |
| e | | | | | x | x | |
| f | | | | | | x | |
| g | | | | | | | x |

- (a) Does A have a smallest element? If so what is it?
(b) Does A have minimal elements? If so what are they?
(c) Does A have a largest element? If so what is it?
(d) Does A have maximal elements? If so what are they?