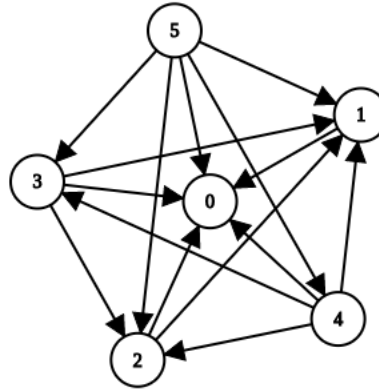
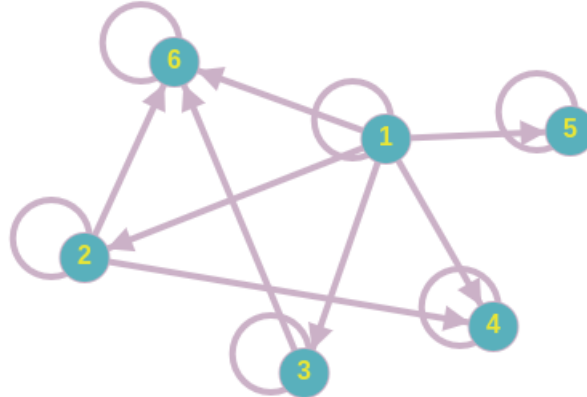


Exercises for Section 11.1

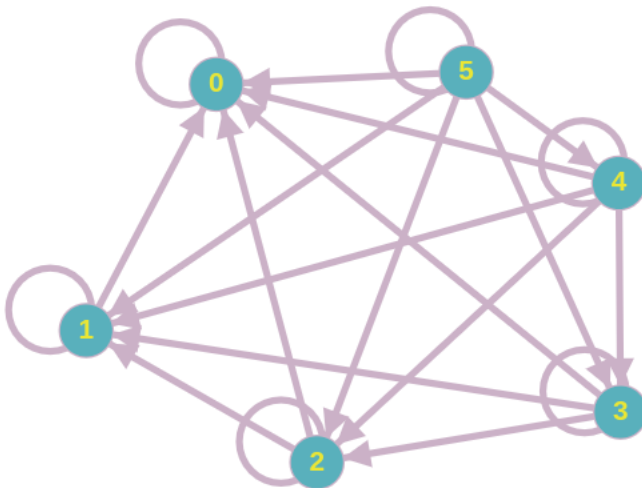
Ex 1. The set $R = \{(5, 0), (5, 1), (5, 2), (5, 3), (5, 4), (4, 0), (4, 1), (4, 2), (4, 3), (3, 0), (3, 1), (3, 2), (2, 0), (2, 1), (1, 0)\}$ is the $>$ relation on A . Diagram of R :



Ex 2. The set $R = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 2), (2, 4), (2, 6), (3, 3), (3, 6), (4, 4), (5, 5), (6, 6)\}$ is the $|$ (divides) relation on A . Diagram of R :



Ex 3. The set $R = \{(0, 0), (1, 0), (1, 1), (2, 0), (2, 1), (2, 2), (3, 0), (3, 1), (3, 2), (3, 3), (4, 0), (4, 1), (4, 2), (4, 3), (4, 4), (5, 0), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5)\}$ is the \geq relation on A . Diagram of R :



Ex 4.

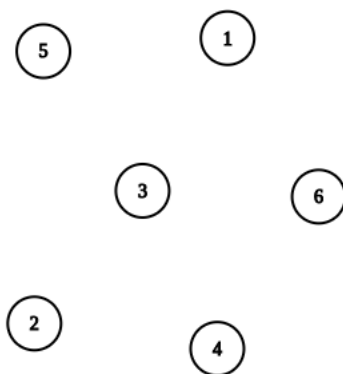
$A = \{0, 1, 2, 3, 4, 5\}$ and $R = \{(0, 0), (0, 4), (1, 1), (1, 3), (1, 5), (2, 2), (2, 4), (3, 3), (3, 1), (4, 4), (4, 0), (4, 2), (5, 5), (5, 1)\}$.

Ex 5. $A = \{0, 1, 2, 3, 4, 5\}$ and $R = \{(1, 2), (2, 5), (3, 3), (4, 2), (4, 3), (5, 0)\}$.

Ex 6. $R = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x \equiv y \pmod{5}\}$.

Ex 7. $R = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : y - x \in \mathbb{N}\}$.

Ex 8. Diagram of R :



Ex 9. The number of relations on A is equivalent to the number of subsets of $A \times A$. Because $|A| = 6$, it follows that $|A \times A| = |A| \cdot |A| = 6^2 = 36$. The number of subsets of a set with 36 elements is then 2^{36} . Thus there are 2^{36} different relations on A .

Ex 10. The set $\{(x, x) : x \in \mathbb{R}\}$ is the equality relation on \mathbb{R} . When we subtract that from cartesian product of \mathbb{R} with itself we get the inequality relation on \mathbb{R} .

Ex 11. There are $2^{|A^2|}$ different relations on A .

Ex 12. R is the \geq relation on \mathbb{R} .

Ex 13. R is the inequality relation on \mathbb{R} .

Ex 14. R is the $<$ relation on \mathbb{Z} .

Ex 15. $R = \{(x, y) \in \mathbb{Z} : 3 | \text{abs}(x - y)\}$.