
Problems:

1. For the relation $R = \{(b,c), (b,e), (c,e), (d,a), (e,b), (e,c)\}$ on $\{a, b, c, d, e, f\}$, compute the following.
   
   (a) The reflexive closure of $R$.
   
   (b) The symmetric closure of $R$.
   
   (c) The transitive closure of $R$.
   
   (d) The reflexive-transitive closure of $R$.

2. A relation $R$ is called circular if $aRb$ and $bRc$ imply that $cRa$ for every $a$, $b$, and $c$. Prove that $R$ is reflexive and circular if and only if it is an equivalence relation.

3. 6th Edition, section 9.2, exercise 36 parts (b), (d), (f), (h), or 5th Edition, section 8.2, exercise 28 parts (b), (d), (f), (h). If no such graph exists, explain why.


5. Prove that if an undirected graph $G$ is not connected, then its complement is connected. (Hint: Try some examples to get an intuition as to why this is true.)

6. Extra credit: Suppose that $G$ is a simple, undirected graph and every vertex of $G$ has degree at least $d$ for some $d \geq 2$. Prove that $G$ must contain a (simple) cycle of length at least $d + 1$. 