C241 HW11 Mini

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1. (a)
   i. No, R is not reflexive. $\neg R(b,b)$.
   ii. No, R is not anti-reflexive. $R(a,a)$.
   iii. No, R is not symmetric. $R(a,b)$ but $\neg R(b,a)$.
   iv. Yes, R is anti-symmetric. The only $x, y \in \{a,b,c,d\}$ that satisfy $R(x,y)$ **and** $R(y,x)$ are the cases where $x = y$ (a & d).
   v. Yes, R is transitive because for all $x, y, z \in \{a,b,c,d\}$, if $R(x,y)$ and $R(y,z)$, $R(x,z)$. Particularly, $R(a,b),\ R(b,d),\ R(a,d)$; $R(a,c),\ R(c,d),\ R(a,d)$; $R(b,d),\ R(d,d),\ R(b,d)$; $R(c,d),\ R(d,d),\ R(c,d)$.

   (b)
   i. No, S is not reflexive. $\neg S(4,4)$.
   ii. No, S is not anti-reflexive. $S(1,1)$.
   iii. No, S is not symmetric. $S(2,4)$ but $\neg S(4,2)$.
   iv. No, S is not anti-symmetric. $S(1,2)$ and $S(2,1)$; $1 \neq 2$.
   v. No, S is not transitive. $S(3,1)$ and $S(1,2)$ but $\neg S(3,2)$.

   (c)
   i. No, E is not reflexive. $\neg E(1,1)$ because 1+1=2 is even.
   ii. Yes, E is anti-reflexive. For any $n \in \mathbb{Z},\ n + n = 2n$, and since $n \in \mathbb{Z},\ 2n$ is even, so $\neg E(n,n)$, so there is no integer n for which $E(n,n)$ holds.
   iii. Yes, E is symmetric. For any $m, n \in \mathbb{Z},\ m+n = n+m$ so $E(m,n)$ iff $E(n,m)$; addition is commutative.
   iv. No, E is not anti-symmetric. $E(1,2)$ and $E(2,1)$.
   v. No, E is not transitive. $E(1,2)$ and $E(2,3)$ but $\neg E(1,3)$.