P607 25

To save time, I will only show one process and others are similar.

a) W1 is $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$, W2 is $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$, W3 is $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$ and W4 is $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$.

The matrix of the transitive closure is: $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$.

b) The matrix of the transitive closure is: $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$.

c) The matrix of the transitive closure is: $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$.

d) The matrix of the transitive closure is: $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$.

P607 27

a) The matrix of the transitive closure is: $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$.

b) The matrix of the transitive closure is: $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$.

c) The matrix of the transitive closure is: $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$.

d) The matrix of the transitive closure is: $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$.

P615 13

xRx is obviously true, so *R* is reflexive.

Assume that *xRy* and *yRz* are true, which means *x* and *y*, *y* and *z* are bit strings that agree in their first and third bits. Then *x* and *z* are bit strings that agree in their first and third bits, which means *xRz* is true. *R* is transitive.

If *x* and *y* are bit strings that agree in their first and third bits, *xRy* and *yRx* are both true obviously. *R* is symmetric.

So we can conclude that *R* is and equivalence relation.

P616 31

a) The set of all bit strings of length 3.

b) The set of all bit strings of length 4 that end with 1.

c) The set of all bit strings of length 5 that end with 11.

d) The set of all bit strings of length 8 that end with 10101.

P630 9

No, because the relation with the directed graph is not transitive.

P630 13

a) $(\{0, 1, 2\}, \geq)$

b) $(Z, \leq)$

c) $(P(Z), \subseteq)$

d) (Z^+, "is a multiple of ")

P631 35

a) {1, 2}, {1, 3, 4}, {2, 3, 4}

b) {1}, {2}, {4}

c) No.

d) No.

e) {2, 4}, {2, 3, 4}

f) {2, 4}

g) {4}, {3, 4}

h) {3, 4}

P650 11

If:

Because *R* is symmetric, *uRv* and *vRu* are both true and then the edges between *u* and *v* is undirected.

Because *R* is irreflexive, there are no loops, or there exists at least a *u* such that *uRu* is true.

So we can conclude *G* is a simple graph.

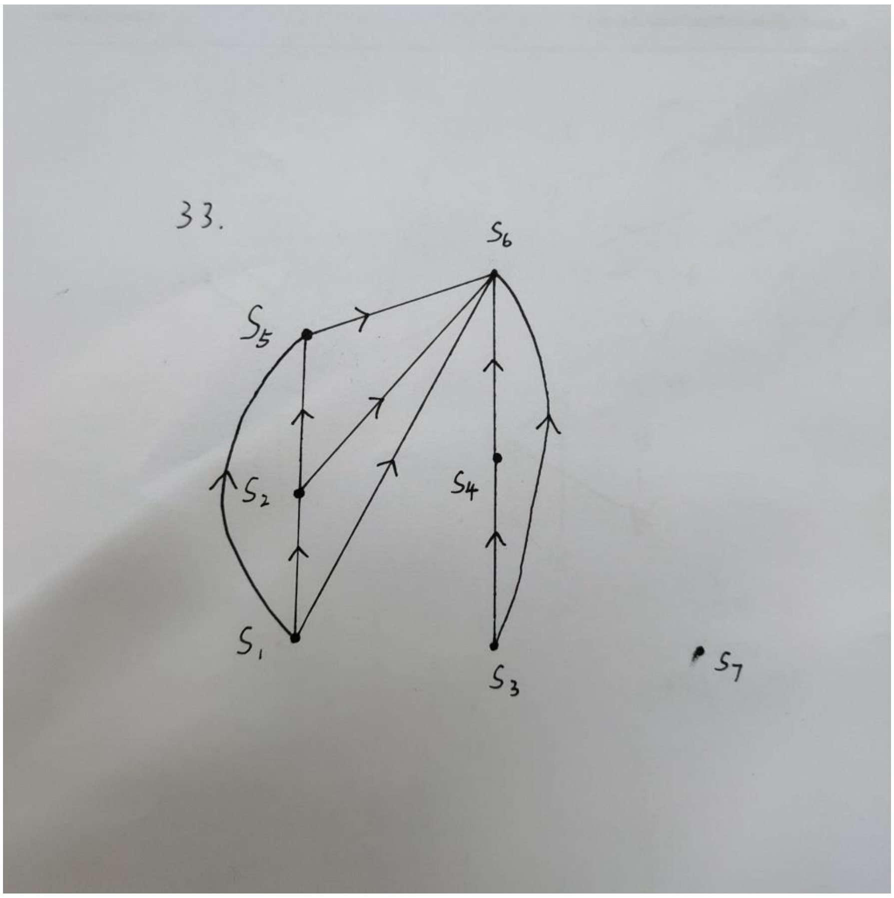
Only if:

Because the edge is undirected, we can have {u, v}={*v, u*} and if *uRv*, then *vRu* must be true. We have *R* is symmetric.

Because no loops exist in a simple graph, *uRu* never holds. We have *R* is irreflexive.

So we can conclude *R* is symmetric and irreflexive.

P651 33



P666 25

No, because if we assign *a* a color first, then *b* and *d* are always assigned the same color.

P667 47

Assume that $\{a_1, a_2, \ldots, a_n\}$ is a nonincreasing sequence of nonnegative integers with an even sum.

For vertex v_i, we put $\left\lfloor \frac{a_i}{2} \right\rfloor$ loops at it, for i=1, 2, …, n.

because the sum is even, we can know the number of vertices that $\deg(v_i)=a_i-1$ is even. We randomly pair these vertices and put edges to connect the pair.

By far, we have constructed a pseudograph that satisfies the requirement.