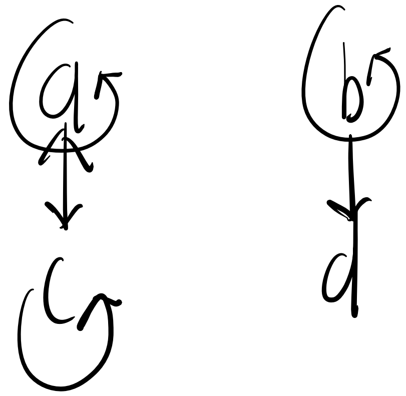
1

$R =$ 

2

$$R \circ S = \{(1,x),(1,y),(4,x),(4,y),(5,x),(2,z),(3,z),(3,z)\}$$

3

$$R_1 \cup R_2 = \{(1,2),(1,3),(1,6),(1,5),(2,1),(3,6),(4,2),(5,6),(6,2),(6,3),(6,6)\}$$

$$R_1 \cap R_2 = \{(1,2),(5,6)\}$$

4

$$R = X \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array} \overset{\begin{array}{ccccc} & & Y & & \\ 1 & 2 & 3 & 4 & 5 \end{array}}{\begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}}$$

not reflexive: diagonal does not consist of all 1s. not (1,1)...

irreflexive: yes it is, 0's on the diagonal

symmetric: yes, $R = R^{-1}$ an $(a,b) = (b,a)$

antisymmetric: no, ex: $(1,2)$ and $(2,1)$
all agree over diagonal

transitive:

$R \circ R \leq R$ is transitive

$$\begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 1 & 0 & 0 & 1 \\ 2 & 1 & 0 & 1 & 0 & 0 \\ 3 & 0 & 1 & 0 & 1 & 0 \\ 4 & 0 & 0 & 1 & 0 & 1 \\ 5 & 1 & 0 & 0 & 1 & 0 \end{array} \circ \begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 1 & 0 & 0 & 1 \\ 2 & 1 & 0 & 1 & 0 & 0 \\ 3 & 0 & 1 & 0 & 1 & 0 \\ 4 & 0 & 0 & 1 & 0 & 1 \\ 5 & 1 & 0 & 0 & 1 & 0 \end{array} = \begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 0 & 1 & 1 & 0 \\ 2 & 0 & 0 & 0 & 1 & 1 \\ 3 & 1 & 0 & 0 & 0 & 1 \\ 4 & 1 & 1 & 0 & 0 & 0 \\ 5 & 0 & 1 & 1 & 0 & 0 \end{array}$$

5 a) Yes it is an equivalent relation, for every entery the age will be the same so they can be found equivalent. a is 47 and so is b and so on, thus they are symmetric. a is 47 so when compared to its self it will also be reflexive. A is 47, b is 47, and so will c. thus transitive.

(b) No it is not. Easiest example is that a is related to b by grand parent. B to C by another grand parent, but A is not related to C so A and C are not equivalent by not being transitive.

(6) I used sibling a few times to mean brother or sister

Reflexive? a = arron

a is brother of a

you can not be your own sibling so it does $\boxed{\text{not}}$ work

Symmetric? a = arron b = brett

a is a sibling of b

yes this can be flipped either way and make sense.

transitive? a = arron b = brett
c = craig

a to b and b to c

the only way that arron and brett could be related so that brett and craig are also siblings is that craig is also arron's sibling. Yes this is transitive if each statement is true

NO, S is not and equivalence relation because it is not symmetric

7

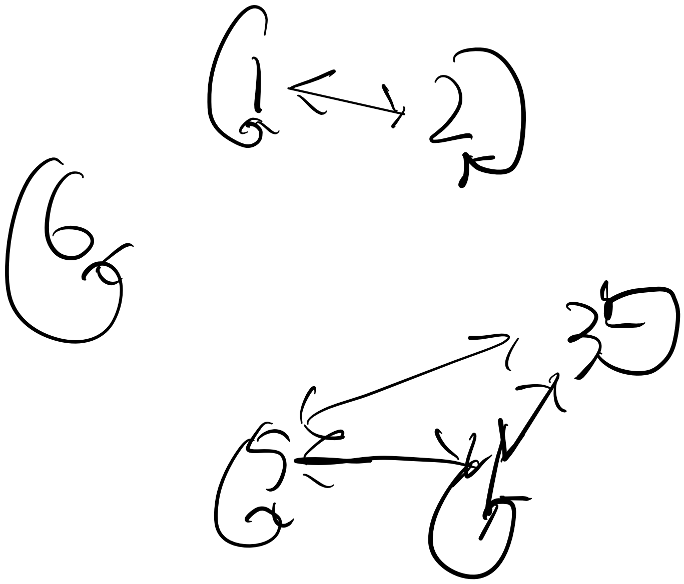
I believe I understand what this question; what is the maximum amount of order pairs possible if not restricted by only one of the 3? that answer is 16. Researching the question led me to believe that we are able to find the answer from the amount of partitions set to the bell numbers. If that is so then the answer is 15. That was applied to a set of $\{1, 2, 3, 4\}$, as I did not understand it fully I counted it out to 16. that's not the same number, but I don't know how to get the answer

$(a, d)\ (d, a)\ (d, c), (c, d), (d, b), (b, d)$

8

$\{1,2,3,4,5,6\}$

$\{1,2\}, \{3,4,5\},$
$\{6\}$



9

$$\begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline 1 & & & \\ 2 & & \left[\begin{matrix} 1 & 0 & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{matrix}\right] & \\ 3 & & & \end{array} \circ \begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline 1 & & & \\ 2 & & \left[\begin{matrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}\right] & \\ 3 & & & \end{array}$$

$$F \circ E = \begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline 1 & & & \\ 2 & & \left[\begin{matrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{matrix}\right] & \\ 3 & & & \end{array} = \{(1,1),(1,2),(2,3),(3,3)\}$$

$\boxed{\text{NO it is not}}$