1. a) Define that for natural numbers \( x \) and \( y \), \( x \equiv y \) if \( x \mod 7 = y \mod 7 \). Then \( \equiv \) is clearly an equivalence relation. What are the equivalence classes of this equivalence?

b) Consider the set \( E = \{1, 2, 3, 4, 5, 6, 7, 8\} \) and a relation \( R \subset E \times E \):

\[
R = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6), (7,7), (8,8),
(1,2), (2,3), (3,4), (5,6), (7,8), (2,1), (4,3), (6,5), (8,7)\}
\]

Why \( R \) is not an equivalence relation?

c) What are the pairs that at least must be added into \( R \) in order to get an equivalence relation? After addition, construct the equivalence classes.

2. For every pair of transition systems in the figure below determine, if the systems are weakly bisimilar or not. If they are, give a weak bisimulation relation. Of not, give reasons.
3.1.3 Give a bisimulation between any two of the following six transition systems.
4. Examine, if the process pairs in V-VII are weakly bisimilar.
5. The FE protocol turned out to be incorrect. Try to correct it and verify your solution by constructing the global state graph. Moreover, minimize the global state graph after hiding all the messages except get and give. Minimize with respect to the weak bisimulation equivalence and to the trace equivalence. (As for the trace equivalence, just use your reasoning and imagination; we have not had systematic methods.)