This miniproject asks you to explain some results regarding the inverse and complementary relations of a given relation R when using either the matrix or the digraph representation. The definition of the inverse and complementary relations are given just prior to #24 in section 8.1.

In the following, R is a generic relation, and S refers to the specific relation on the set $A = \{1, 2, 3, 4, 5\}$ given by $S = \{(1,1), (1,3), (1,4), (2,2), (2,3), (2,4), (3,1), (3,2), (4,1), (4,3), (4,4), (4,5), (5,5)\}$.

(a) Give the matrix representation of the relation S that was given above.

(b) Give a digraph representation of the relation S.

(c) (i) If $\overline{R}$ is the complement relation of R, explain how to get the matrix representation of $\overline{R}$ directly from the matrix representation of R.

   (ii) Give the matrix representation of $\overline{S}$.

(d) (i) If $\overline{R}$ is the complement relation of R, explain how to get the digraph representation of $\overline{R}$ directly from the digraph representation of R.

   (ii) Give the digraph representation of $\overline{S}$.

(e) (i) If R^{-1} is the inverse relation of R, explain how to get the matrix representation of R^{-1} directly from the matrix representation of R.

   (ii) Give the matrix representation of S^{-1}.

(f) (i) If R^{-1} is the inverse relation of R, explain how to get the digraph representation of R^{-1} directly from the digraph representation of R.

   (ii) Give the digraph representation of S^{-1}.

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