



PREFERENCES AS BINARY RELATIONS

1. For all the questions below, the binary relation is represented by a $m \times m$ matrix ($3 \leq m \leq 20$) given in an Excel file (.xls or .xlsx).
 - ★ You could implement a Python function converting this file to a .csv file.
2. Implement a Python function `Visualizebinaryrelation` showing a graphical representation of the matrix, by using an appropriate package like `networkx` or `matplotlib`.
3. Build a Python function `CompleteCheck` testing if a binary relation is complete.
4. Build a Python function `ReflexiveCheck` testing if a binary relation is reflexive.
5. Build a Python function `AsymmetricCheck` testing if a binary relation is asymmetric.
6. Build a Python function `SymmetricCheck` testing if a binary relation is symmetric.
7. Build a Python function `AntisymmetricCheck` testing if a binary relation is antisymmetric.
8. Build a Python function `TransitiveCheck` testing if a binary relation is transitive.
9. Build a Python function `NegativetransitiveCheck` testing if a binary relation is negativetransitive.
10. Build a Python function `CompleteOrderCheck` testing if a binary relation is a total order.
11. Build a Python function `CompletePreOrderCheck` testing if a binary relation is a complete pre-order.
12. Build a Python function `StrictRelation` returning the asymmetric part of a binary relation.
13. Build a Python function `IndifferenceRelation` returning the symmetric part of a binary relation.
14. Build a Python function `Topologicalsorting1` returning a topological sorting of a given binary relation without cycles and the indifference pairwise comparisons (the binary relation contains only the asymmetric part).

15. Build a Python function `Topologicalsorting2` returning a topological sorting of a given binary relation where the indifference pairwise comparisons exist (both asymmetric and symmetric parts are nonempty).

16. Test all the functions above, by using the binary relation \mathcal{B} on a set $X = \{a, b, c, d, e, f\}$ defined by :

$$a \mathcal{B} a, a \mathcal{B} b, a \mathcal{B} c, a \mathcal{B} d, a \mathcal{B} e, a \mathcal{B} f$$

$$b \mathcal{B} b, b \mathcal{B} c, b \mathcal{B} d, b \mathcal{B} e, b \mathcal{B} f$$

$$c \mathcal{B} c, c \mathcal{B} d, c \mathcal{B} e, c \mathcal{B} f$$

$$d \mathcal{B} b, d \mathcal{B} c, d \mathcal{B} d, d \mathcal{B} e$$

$$e \mathcal{B} d, e \mathcal{B} e, e \mathcal{B} f$$

$$f \mathcal{B} e, f \mathcal{B} f$$

17. Build a Python function `generatebinaryrelation` generating a binary relation, on a set of 6 objects, containing at least 10 pairwise comparisons and such that the transitive and negative transitive properties are not satisfied.