Storage Problem

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Plan for the talk:

- **Storage problem**
- **Real world problem**
- **Graph construction**
- **Special properties**
- **Problem solution**

Storage Problem

A company manufactures chemicals. On demand the company supplies chemicals to customers. The company produces n number of chemicals, in which some of them are not compatible with few others. While storing the chemicals altogether in a warehouse might result in explosion. In order to avoid collision the warehouse is to be partitioned into different compartments for the storage of compatible chemicals into one compartment.

Real world problem

- **Below is the matrix representation of compatibility relationship between different chemical products stored, it explains whether the chemical can be stored along with that particular chemical product or not.**

Compatibility check Matrix

	Inorganic acids	Organic acids	Caustics	Amines	Halogenated compounds	Alcohols, Glycol, Glycol Ether
Inorganic acids		✓	✓	✓		✓
Organic acids	✓			✓		
Caustics	✓					✓
Amines	✓	✓			✓	
Halogenated compounds				✓		
Alcohols, Glycol, Glycol Ether	✓		✓			

Graph construction

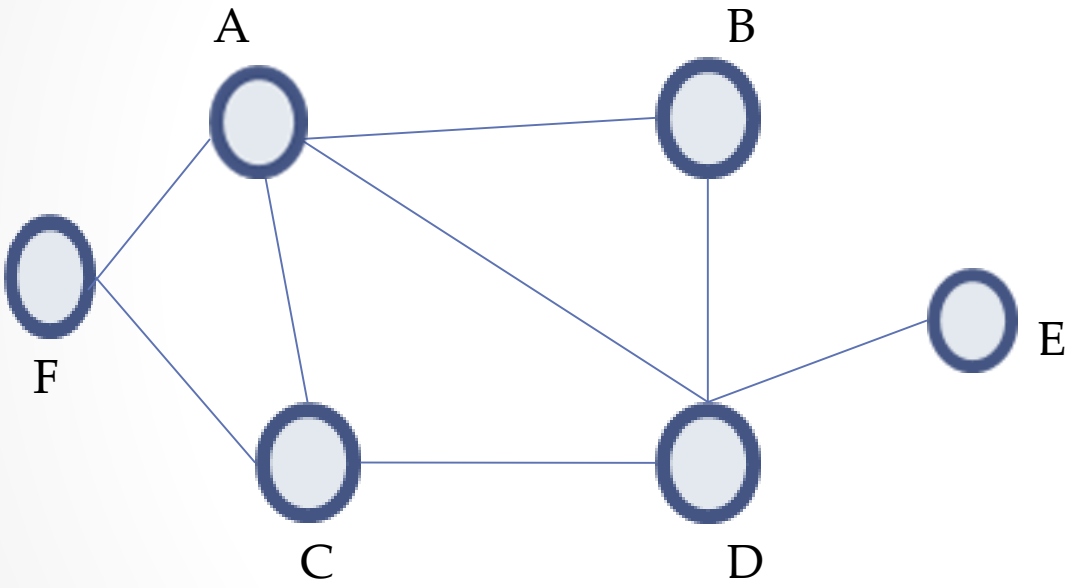
From the adjacency matrix we represent the problem in the graph format.

- **Consider each chemical as a vertex.**
- **Join two vertices if and only if they are not compatible with each other.**
- **Complete the construction of graph by considering the adjacency list.**

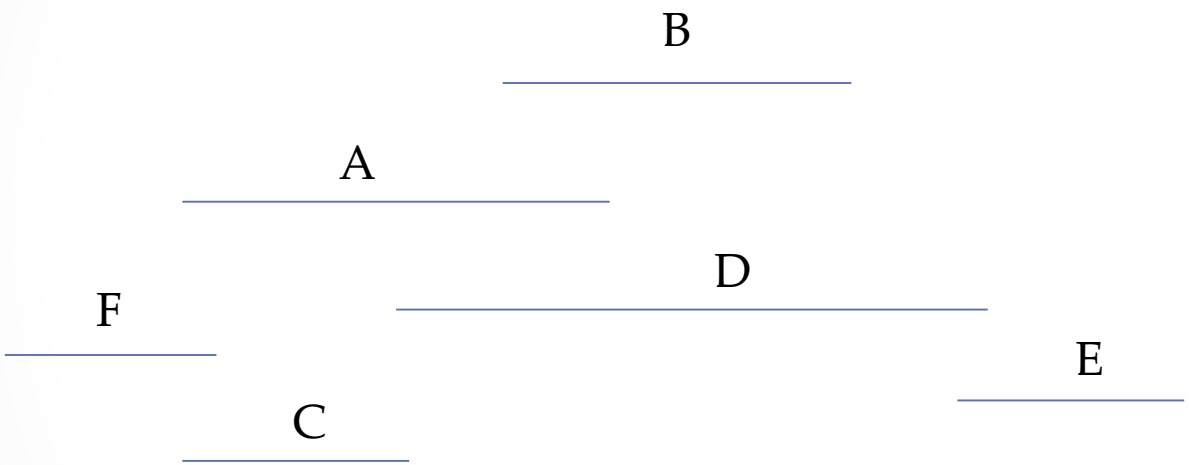
Adjacency List

vertices	incompatible vertex
a	b c d f
b	a d
c	a d f
d	a b c e
e	d
f	a c

Interpreting graph for real world problem



Interval graph



Special properties

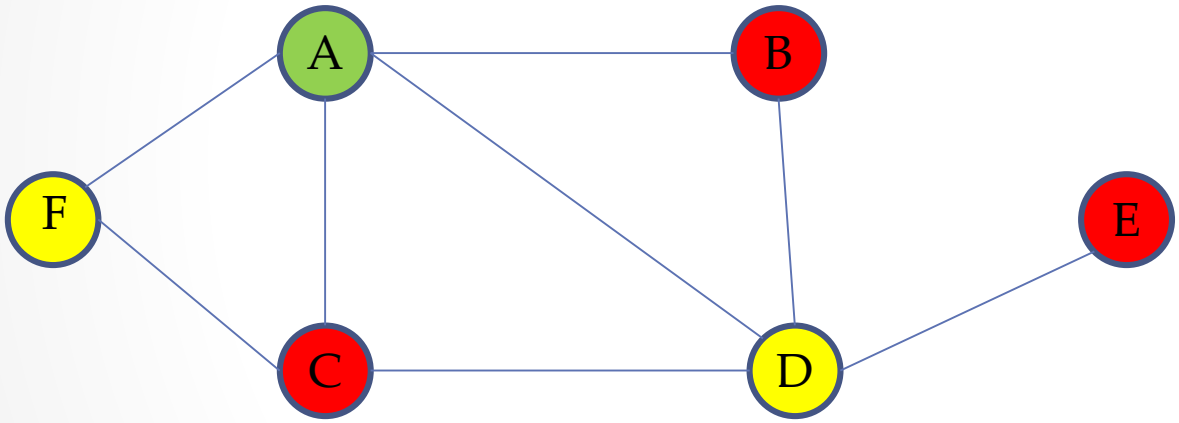
- **Vertex coloring : Assigning of colors to labels of a graph G such that no two vertices of a edge have identical colors.**
- **Chromatic number : Chromatic number G of a graph is the minimum number of colors require to color the vertices of a graph so that no two vertices share the same color.**
- **Stability number : The stability number of a graph G is the cardinality of the largest stable set.**
- **Stable set : Stable set of G is a subset of the vertices such that no two of them are connected by an edge.**

Interpreting graph solution to real life problem

- **By identifying the chromatic number to the graph we can solve the storage problem by partition the warehouse into a number equals to the chromatic number.**
- **For assigning compartment number to chemicals can be done by special property independent set.**

Graph coloring

The chromatic number for this graph is 3. So the warehouse should be partitioned into three compartments for storage



Assign F, D - compartment 1

B, C, E - compartment 2

A – compartment 3

Compartments	Vertices
1	F D
2	B C E
3	A

References

- https://www.case.edu/ehs/ChemSafety/compatComplex.pdf
- http://ijcem.in/wp-content/uploads/2014/05/A-study-of-Vertex-Edge-Coloring-Techniques-with-Application.pdf
- http://www.iro.umontreal.ca/~hahn/IFT3545/GTWA.pdf

Any questions ???????