EXERCISE AND SOLUTION

(ARC CONSISTENCY)

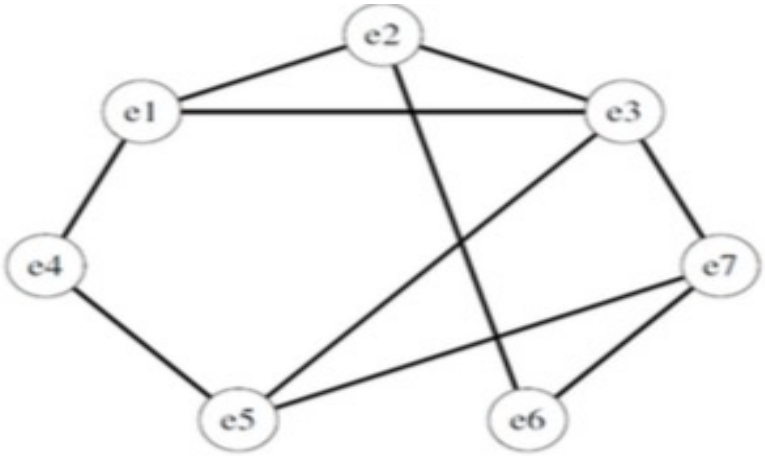
CSP: arc-consistency

Consider a map coloring problem that can be modelled via a CSP with

- Variables: e1, e2, e3, e4, e5, e6, e7
- Domains:
  - Domain of e1, e3, e4, e5, e6 is { R , G , B }
  - Domain of e2 = { R }
  - Domain of e7 = { B }
- Constraints: specified by the following constraint graph

CSP: arc-consistency

- Constraints: specified by this constraint graph.
  - There is an arc between two variables
    if they must have different colors



- Apply arc-consistency and show how the domains change

Review: Arc consistency

- A **variable** is **arc-consistent** if **every value** in its domain satisfies the variable's **binary constraints**

  Formally:

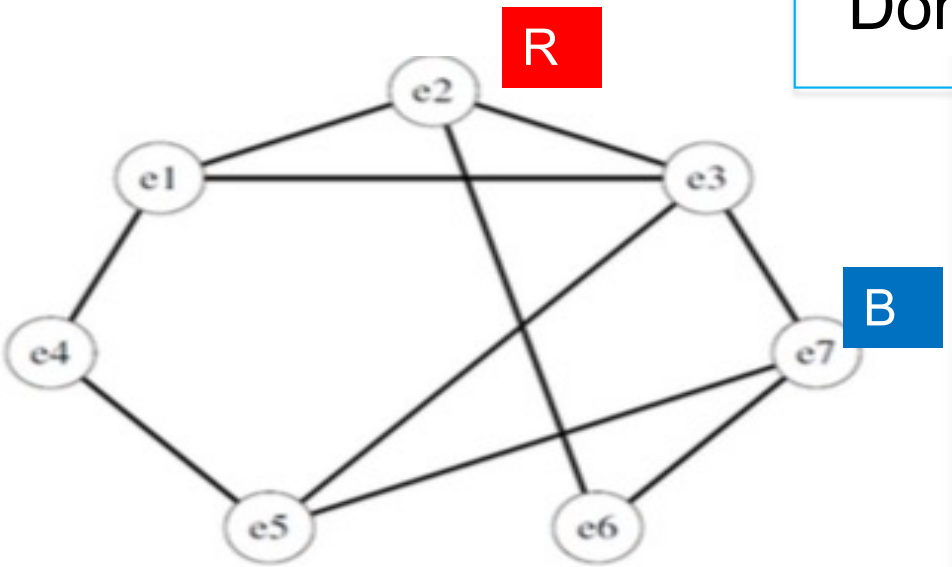
  Assume there is a binary **constraint** between $\mathbf{X_i}$ and $\mathbf{X_j}$,

  $\mathbf{X_i}$ is **arc consistent** with respect to $\mathbf{X_j}$ iff

  for every value *x* for $\mathbf{X_i}$, there is **some allowed** *y* *for* $\mathbf{X_j}$ that **satisfies** the binary constraint between $\mathbf{X_i}$ and $\mathbf{X_j}$

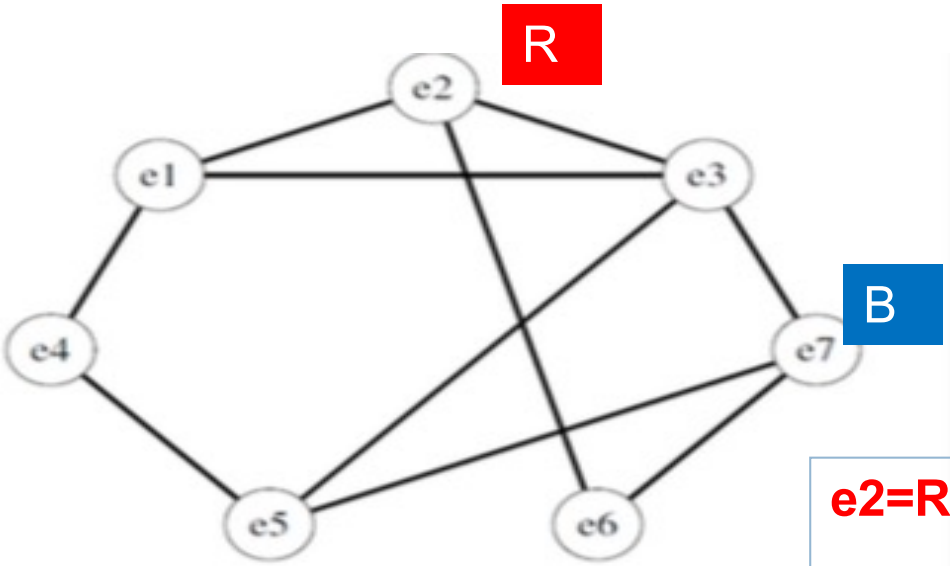
CSP: arc-consistency

Domain of e1,e3,e4,e5,e6
D={ R , G , B }
Domain of e2 = { R }
Domain of e7 = { B }



e1	e2	e3	e4	e5	e6	e7
R G B	R	R G B	R G B	R G B	R G B	B

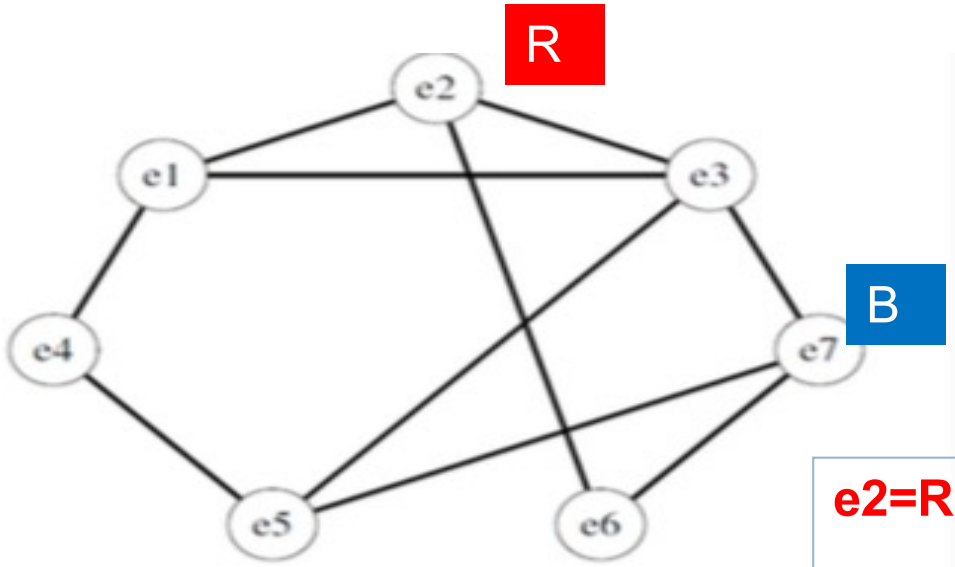
CSP: arc-consistency



e2=R ➔ Remove **R** from the domain of **e1, e3, e6**

e1	e2	e3	e4	e5	e6	e7
~~R~~ G B	R	~~R~~ G B	R G B	R G B	~~R~~ G B	B

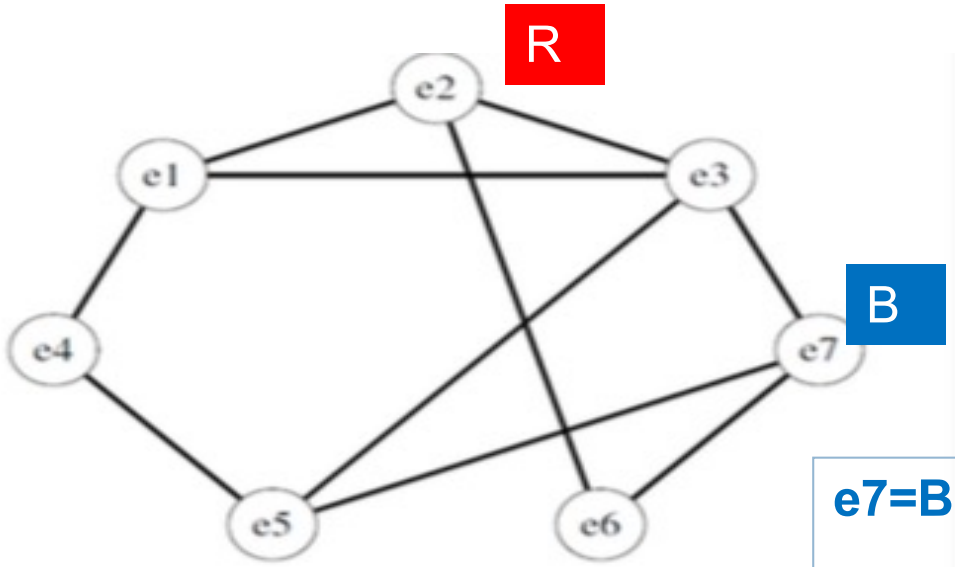
CSP: arc-consistency



e2=R ➔ Remove **R** from the domain of **e1, e3, e6**

e1	e2	e3	e4	e5	e6	e7
G B	R	G B	R G B	R G B	G B	B

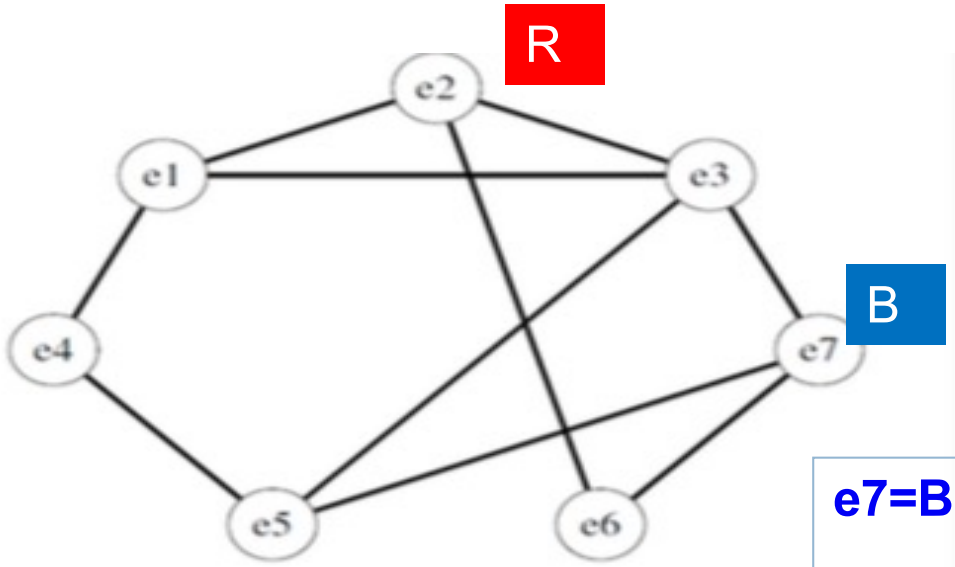
CSP: arc-consistency



e7=B ➔ Remove **B** from the domain of **e3, e5, e6**

e1	e2	e3	e4	e5	e6	e7
G B	R	G ~~B~~	R G B	R G ~~B~~	G ~~B~~	B

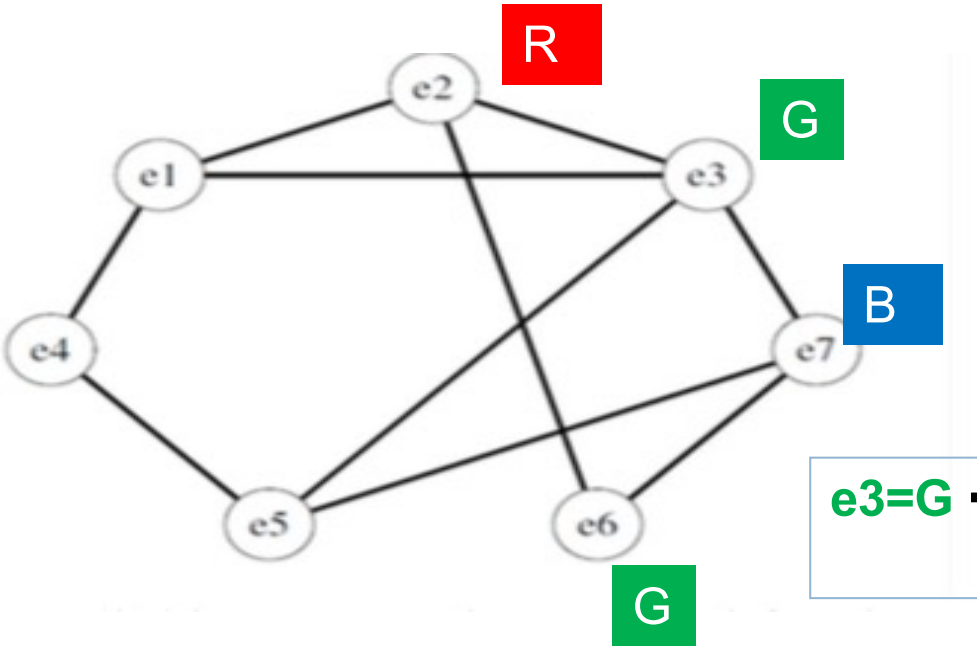
CSP: arc-consistency



e7=B ➔ Remove **B** from the domain of **e3, e5, e6**

e1	e2	e3	e4	e5	e6	e7
G B	R	G	R G B	R G	G	B

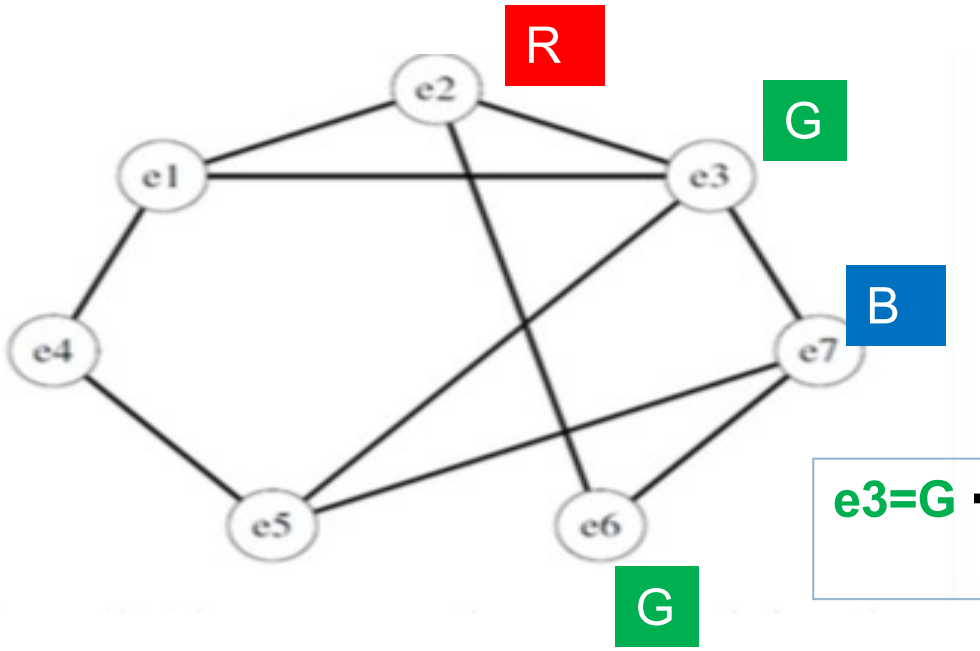
CSP: arc-consistency



e3=G ➔ Remove **G** from the domain of **e1, e5**

e1	e2	e3	e4	e5	e6	e7
~~G~~ B	R	G	R G B	R ~~G~~	G	B

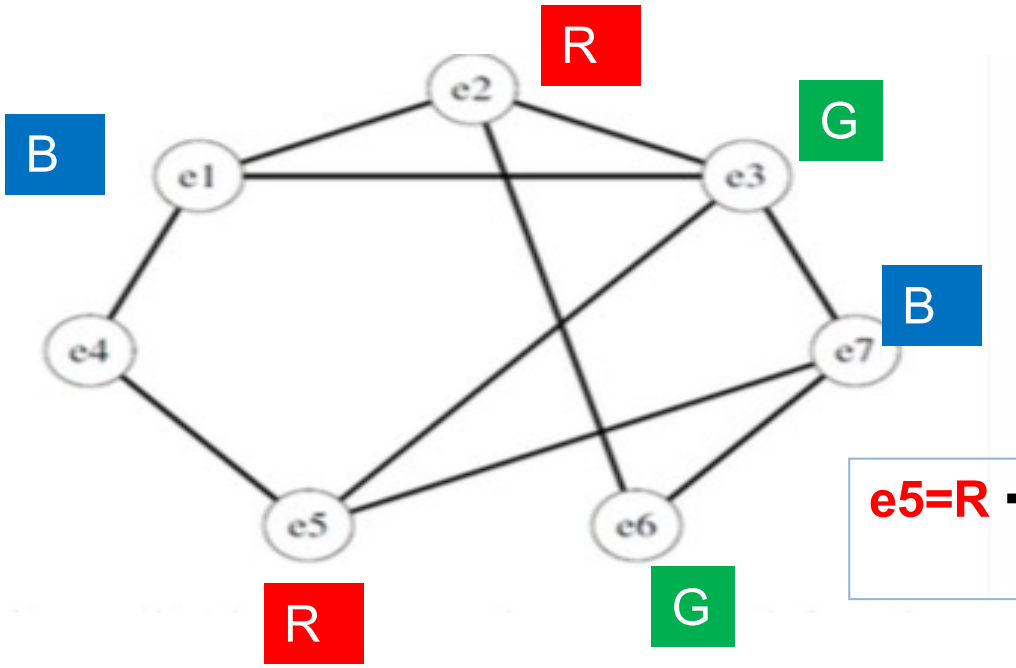
CSP: arc-consistency



e3=G ➔ Remove **G** from the domain of **e1, e5**

e1	e2	e3	e4	e5	e6	e7
B	R	G	R G B	R	G	B

CSP: arc-consistency



e5=R ➔ Remove **R** from the domain of **e4**

e1	e2	e3	e4	e5	e6	e7
B	R	G	~~R~~ G B	R	G	B

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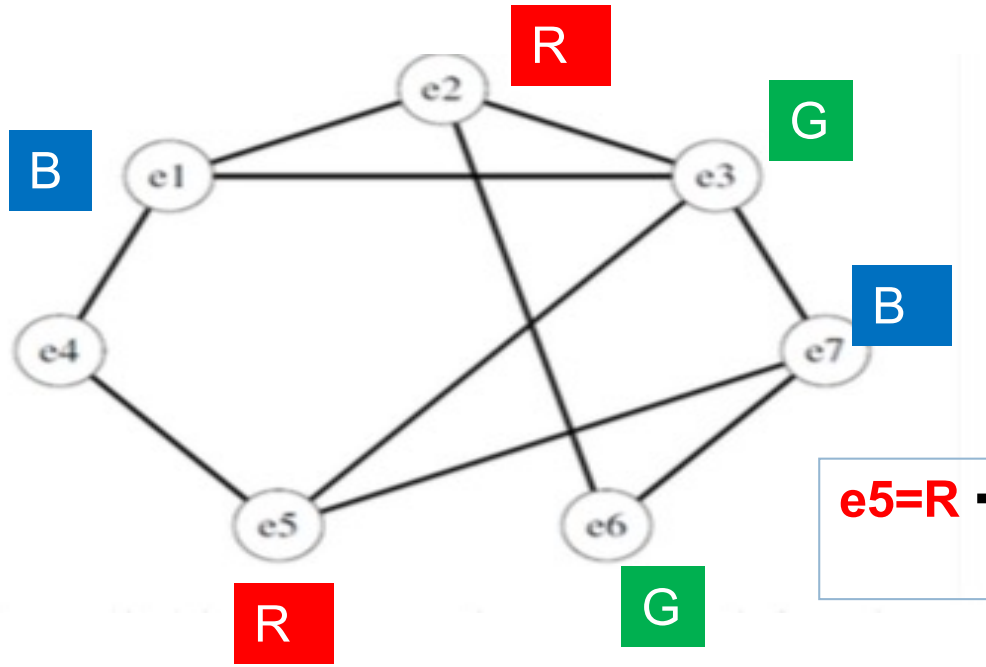
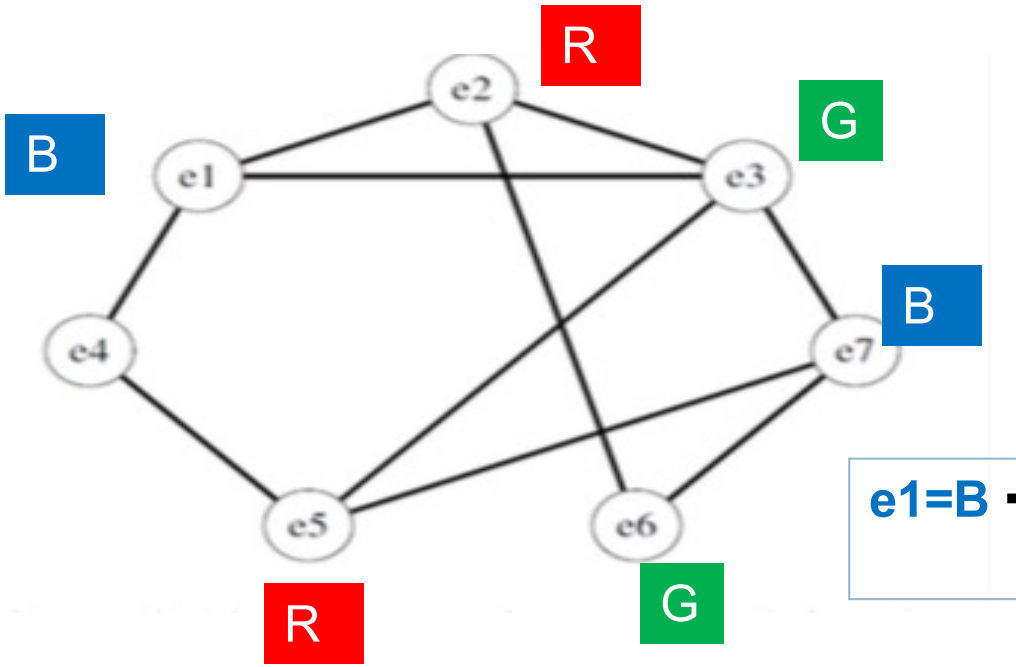


e5=R ➔ Remove **R** from the domain of **e4**

e1	e2	e3	e4	e5	e6	e7
B	R	G	G B	R	G	B

CSP: arc-consistency



e1=B ➔ Remove **B** from the domain of **e4**

e1	e2	e3	e4	e5	e6	e7
B	R	G	G ~~B~~	R	G	B

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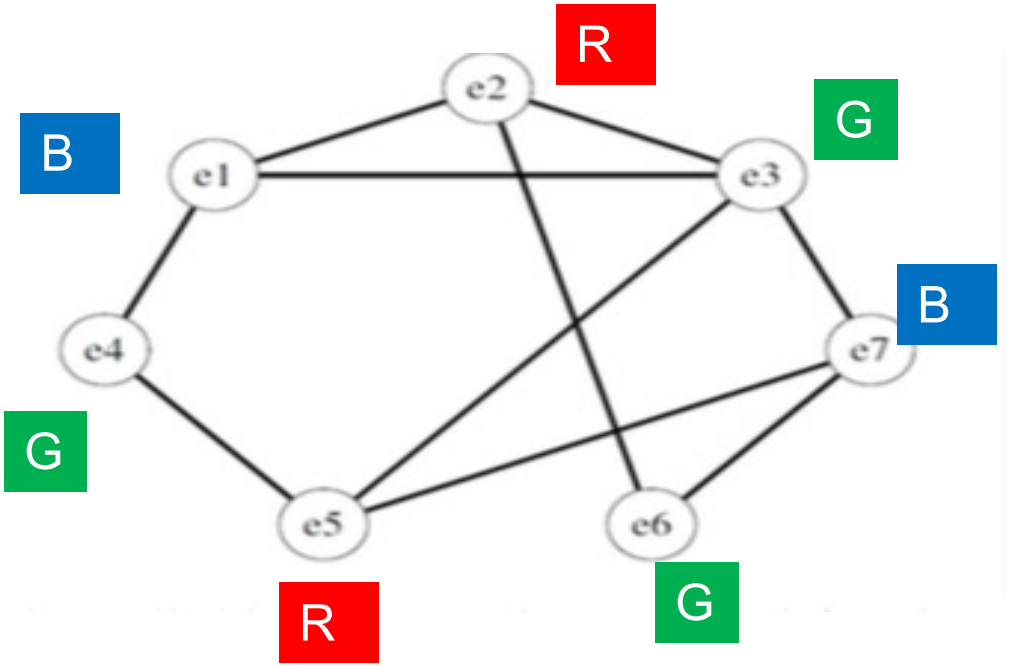

e1	e2	e3	e4	e5	e6	e7
B	R	G	G	R	G	B