REVIEW EXERCISE 04

Question 1. You are designing a menu for a special event. The menu includes four dishes, each of which is a variable: **(A)**ppetizer, **(B)**everage, main **(C)**ourse, and **(D**)essert.
The domains of the variables are as follows:

A: (v)eggies, **(e)**scargot
B: (w)ater, **(s)**oda, **(m)**ilk
C: (f)ish, **(b)**eef, **(p)**asta
D: (a)pple pie, **(i)**ce cream, **(ch)**eese

Because all of your guests get the same menu, it must obey the following dietary constraints:

(i) Vegetarian options: If you serve the veggies, you must avoid everything made of meat (red meat, poultry, seafood, etc.)
(ii) Dairy products lover: You must serve at least one of milk, ice cream, or cheese.
(iii) Digestible: The main course must be fish or the beverage must be water or soda.

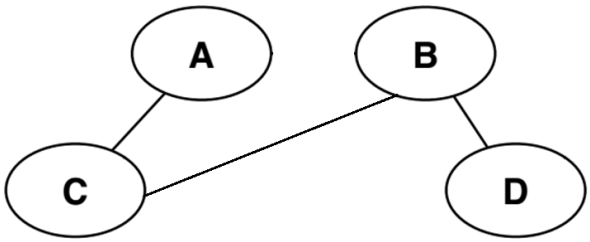
Formulate the problem as a CSP, stating the variables and corresponding domains.

Variables	A	B	C	D
Domains	v,e	w,s,m	f,b,p	a,i,ch

Binary constraints:

A and C (constraint i)	B and C (constraint iii)	B and D (constraint ii)

Draw the constraint graph associated with your CSP, in which each node represents a variable and an edge connecting two nodes represents the relation between the two variables denoted by these nodes.



Again imagine we first assign A=v. Cross out eliminated values to show the domains of the variables after arc consistency has been enforced.

Variables	A	B	C	D
Domains	**v**	w,s, ~~m~~	~~f,b~~,p	~~a,~~i,ch

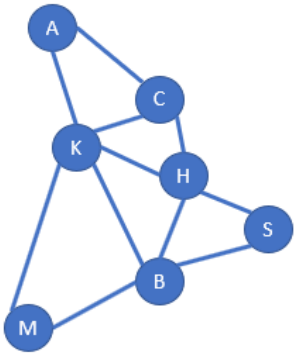
Give a solution for this CSP or state that none exists.

One of many solutions: A = v, B = w, C = p, D = i

Question 2. You are a map-coloring robot assigned to color the given map. Adjacent regions must be colored a different color (R=Red, B=Blue, G=Green).

Map of south-west of Vietnam

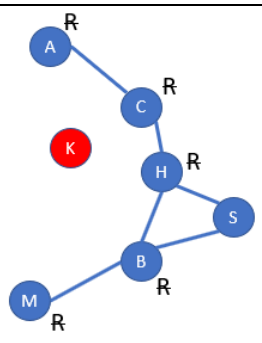
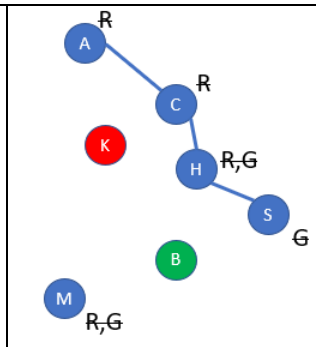
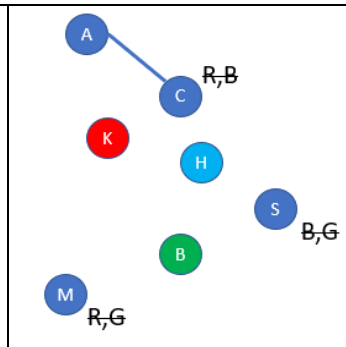
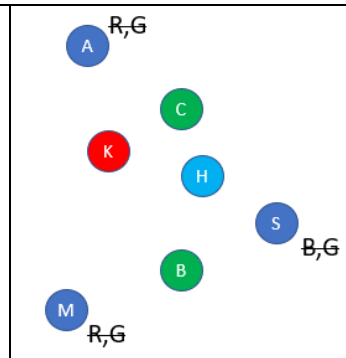
a) Draw the constraint graph



b) Find a solution by using backtracking search with appropriate heuristics (MRV, DH, and LCV). Explain your answer in detail.

LCV is implicitly implemented by the order of coloring: R, G, and B.

- Initially, all vertices have the same MRV = 3. Kien Giang has the highest DH = 5 → Kien Giang: Red (Figure A)
- An Giang, Bac Lieu, Ca Mau, Can Tho and Hau Giang have the same lowest MRV = 2. Bac Lieu and Hau Giang have the same highest DH = 3. Choose randomly among those vertices → Bac Lieu: Green (Figure B)
- Ca Mau and Hau Giang have the same lowest MRV = 1. Hau Giang has a higher DH = 2 → Hau Giang: Blue (Figure C)
- Can Tho, Ca Mau, and Soc Trang have the same lowest MRV = 1. Can Tho has the highest DH = 1 → Can Tho: Green (Figure D)
- Remaining vertices are isolated ones → Soc Trang: Red, Ca Mau: Blue, An Giang: Blue

			
A	B	C	D