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Problem 1:

1.) Domain: Every domino can be assigned a pair of adjacent squares.
Constraint: Two dominoes must not share a common square.

So, D={(a,b)| (a,b) is in R where R is the region defined in the problem}
and Constraint C can be written as : For any two domino d_i and d_j must not have any square in common (1<=i,j<=n)

2.) In this case square is the variable.So every square can be said to be paired with the adjacent square such that the domino covers those pair of square.

So for every square i we can write the domain of i as D_i = {j | (i,j) or (j,i) is in R}
So basically every square is assigned the number of its partner square both of which would be covered by a single domino.

Constraint: Let f be the relation governing the assignment i.e f(x)=y means square x is assigned number y then

- f(x)=y implies f(y)=x
- f(x)=y then x can not be equal to y

3.)

The initial state of the problem is as follows:

Variable	Domain	value
S1	{2}	NA
S2	{1,3,5}	NA
S3	{2,4}	NA
S4	{3}	NA
S5	{2,6,7}	NA
S6	{5}	NA
S7	{5,8}	NA
S8	{7,9,11}	NA
S9	{8,10,12}	NA
S10	{9,13}	NA
S11	{8,12}	NA
S12	{9,11,13}	NA
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step1 (Choice of variable and value): Here Varaibles (squares) S1,S4,S6 are most constrained and among those S1 is the one with least index (as told in heuristic given in part 4) so S1=2 and by constrained S2=1

Step2(forward checking): Now squares 1 and 2 are assinged as they cant be assigned a different value and domain of other square having s1 and s2 in their domain will be changed, hence we have the following new state :

Variable	Domain	value
S1	Null	2
S2	Null	1
S3	{4}	NA
S4	{3}	NA
S5	{6,7}	NA
S6	{5}	NA
S7	{5,8}	NA
S8	{7,9,11}	NA
S9	{8,10,12}	NA
S10	{9,13}	NA
S11	{8,12}	NA
S12	{9,11,13}	NA
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step3: Most constrained squares are S3,S4,S6, . Hence S3 = 4.

Step4: New Domains:

Variable	Domain	value
S1	Null	2
S2	Null	1
S3	Null	4
S4	Null	3
S5	{6,7}	NA
S6	{5}	NA
S7	{5,8}	NA

S8	{7,9,11}	NA
S9	{8,10,12}	NA
S10	{9,13}	NA
S11	{8,12}	NA
S12	{9,11,13}	NA
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step5: Most constrained square S6, hence S6=5
Step6: New Domains:

Variable	Domain	Initial value
S1	Null	2
S2	Null	1
S3	Null	4
S4	Null	3
S5	Null	6
S6	Null	5
S7	{8}	NA
S8	{7,9,11}	NA
S9	{8,10,12}	NA
S10	{9,13}	NA
S11	{8,12}	NA
S12	{9,11,13}	NA
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step7: Most constrained square S7, hence S7=8
Step8: New Domains:

Variable	Domain	Initial value
S1	Null	2
S2	Null	1
S3	Null	4
S4	Null	3

S5	Null	6
S6	Null	5
S7	Null	8
S8	Null	7
S9	{10,12}	NA
S10	{9,13}	NA
S11	{12}	NA
S12	{9,11,13}	NA
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step9: Most Constrained variable S11, so S11=12
Step10: New Domains and assignment:

Variable	Domain	Initial value
S1	Null	2
S2	Null	1
S3	Null	4
S4	Null	3
S5	Null	6
S6	Null	5
S7	Null	8
S8	Null	7
S9	{10}	NA
S10	{9,13}	NA
S11	Null	12
S12	Null	11
S13	{10,12,14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

Step 11: Most Constrained Variable S9,so S9=10.

Step12: New Domains and assignments:

Variable	Domain	Initial value
S1	Null	2
S2	Null	1
S3	Null	4
S4	Null	3
S5	Null	6
S6	Null	5
S7	Null	8
S8	Null	7
S9	Null	10
S10	Null	9
S11	Null	12
S12	Null	11
S13	{14,15}	NA
S14	{13,16}	NA
S15	{13,16}	NA
S16	{14,15}	NA

4.) All the steps above have been made by taking into consideration the heuristic given in this part, and all the steps upto 12 are being given above and theri decription in step1 and step 2 is also done.

Problem 2:

1.) Follwong can be the CSP modelling of the problem:

* Varaibles – X={x1,x2,x3} where variables represent the three positions.
* Domain: each variable can be any of the persons that Arthur knows i.e
D={Peter, John, Jim, Jane, Mary, Bruce, Chuck}
* Constraint:-
  - All of the x_i s should be different
  - atleast one among X should know C#
  - atleat 2 should know Flash design
  - atleast 1 photoshop Guru
  - atleast 1 database admin
  - atleast 1 Systems Engineer

2.) Now we have another constraint that they can afford only 2 single booted workstation.And we can see that Authur and Jim uses Windows and FreeBSD repectively so the 2 OS has to be windows and FreeBSD.So now only with people using windows and freebsd are to be considered, hence domain reduces to:

D={Chuck,Jane,John,Peter}

3.) Let the **varaibles** represent the work schedule of 4 employes where each each work scchedule w1 can be represented as group of intervals denoting the start time and end time of every shift For eq.
w1=[(start1,end1)
(start2,end2)
....
($start_n$,end_n)] where every $start_i$ and end_i contains the info of day and time.

Domain will be all possible work schedules.

Constraint and its Effect:

C1: Total 50 hrs must be put in altogether
Impact: Reduces the domain to have only those schedules having 50 hrs.

C2: Only 2 persons can work at the same time and use different OS if they work at same time
Impact: Domain gets ruduced due to forward checking and constrained propogation.

C3:Work hours between 9 am and 5 pm
Impact : Reduces the Domain due to limit

C4: Each person should work a maximum of 20 hrs i.e sum of all hours <=20
Impact: This also reduces the domain as it limits the total number of hours.

C5: one work shift is greater than 2 hrs i.e end-start>=2
Impact: limits the number of shifts as there cannot be many small small shifts now

C6:No interval of Arthur on tuesday / thursday should intersect the interval 12-4pm
Impact: Reduces the domain of Arthur

C7: No interval of Jim on Mon,Wed,Fri should intersect the interval 9-12
Impact: Reduces the domain of Jim

C8: All work shifts of Bruce should be between 12-2pm
Impact: Restrict the Domain of Bruce.

C9:All work shifts of Mary must be on thrusday
Impact: Restrict the Domain of Mary.