Offline 2 Report

Value Order Heuristic:

For Ordering the value of a selected unassigned variable “**Least Constraining Value**” heuristic is used because this heuristic prioritize the value of a variable which cause the less shrink of domain of neighbouring unassigned variables of that variable.That’s why this heuristic helps to choose the right path of search tree (for both BT and FC) as early as possible and so it reduces the number of nodes and number of backtracks and thus it improves the run time on average.

Data Table

Problem	Solver	VAH	#Node	#BT	Time(ms)
d-10-01	BT	VAH1	2941	2630	69
	BT	VAH2	*	*	*
	BT	**VAH3**	**446**	**384**	**11**
	BT	VAH4	463	399	8
	BT	VAH5	*	*	*
	FC	VAH1	311	21	29
	FC	VAH2	1561662	685543	26617
	FC	**VAH3**	**62**	**1**	**4**
	FC	VAH4	64	2	4
	FC	VAH5	456826	194406	8721
d-10-06	BT	VAH1	595	519	5
	BT	VAH2	*	*	*
	BT	**VAH3**	**408**	**350**	**8**
	BT	VAH4	409	351	4

	BT	VAH5	196776889	196776831	666038 =11.1 min
	FC	VAH1	76	1	5
	FC	VAH2	5709596	2145955	94348
	FC	VAH3	58	0	
	FC	**VAH4**	**58**	**0**	**3**
	FC	VAH5	637654	277821	11089
d-10-07	BT	VAH1	395	337	6
	BT	VAH2	*	*	*
	BT	VAH3	850	748	11
	BT	**VAH4**	**380**	**322**	**8**
	BT	VAH5	*	*	*
	FC	VAH1	58	0	3
	FC	VAH2	293062	129097	5662
	FC	VAH3	102	5	5
	FC	**VAH4**	**58**	**0**	**3**
	FC	VAH5	201934	83255	4015
d-10-08	**BT**	**VAH1**	**1050**	**929**	**15**
	BT	VAH2	*	*	*
	BT	VAH3	3562	3190	41
	BT	VAH4	6816	6117	76
	BT	VAH5	*	*	*
	FC	**VAH1**	**121**	**4**	**4**
	FC	VAH2	776581(>=)	317390(>=)	14692(>=)
	FC	VAH3	372	29	18
	FC	VAH4	699	80	29
	FC	VAH5	15960	6702	832
d-10-09	**BT**	**VAH1**	**441**	**383**	**5**
	BT	VAH2	*	*	*
	BT	VAH3	532	462	8
	BT	VAH4	459	395	4
	BT	VAH5	*	*	*
	FC	**VAH1**	**58**	**0**	**3**

	FC	VAH2	69655	31551	1616
	FC	VAH3	70	3	3
	FC	VAH4	64	1	6
	FC	VAH5	3157421	1303795	48790
d-15-01	BT	VAH1	1908745	1781470	17434
	BT	VAH2	*	*	*
	BT	**VAH3**	**1215038**	**1134011**	**11592**
	BT	VAH4	2772581	2587716	25817
	BT	VAH5	*	*	*
	FC	VAH1	127275	12290	9214
	FC	VAH2	*	*	*
	FC	**VAH3**	**81027**	**8412**	**6715**
	FC	VAH4	184865	21785	14878
	FC	VAH5	*	*	*

Observation:

Comparison between BT and FC:

So,overall ,It is evident that between two solver (BT and FC),definitely **FC** performs better because it can intelligently and quickly detect the failure path and find the solution by exploring less search node than BT.

Comparison Among 5 Heuristics:

Among the 5 heuristics,we can see for 1st four test cases,VAH3 and VAH4 perfoms almost equally better but on average VAH3 performs better than VAH4 because in VAH4 there can be case where a variable with higher domain size can be selected which results to inefficiency.

And for last problem , VAH3 performs much better than all heuristics.That means for larger input and data,VAH3 provides better performance as it can select a variable by evaluating two heuristic metric(Least domain and most constraint) .That's so it can find the solution more efficiently and quickly for larger input.

VAH5 picks a variable randomly from the remaining usassigned variables of a node and that's why runtime and the number of nodes for this heuristic defers each time of running but on average it provides very poor performance which is very evident form the above datatable.

VAH2 is the heuristic which is generally used to break the tie when VAH1 is applied.But applying VAH2 along provides very poor performance.

Conclusion:

So overall,

VAH1 provides quite good performance,VAH3 and VAH4 perform far better than VAH1 as it combines the benefit of both heuristic VAH1 and VAH2

VAH2 and VAH5 provides very poor performance comparing with others

Overall, VAH3 >VAH1 > VAH4 >VAH5>VAH2

So observing all the schemes from the data table we can conclude that FC+VAH3 provides asymptotically best performance.