

Report  
CSE 318  
Artificial Intelligence Sessional

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January 2023

## 1 Introduction

We are to design an exam time table for students using **local search**.

## 2 Table

The results generated with the implemented algorithms and heuristics are given below:

### 2.1 Scheme-1: Largest Degree

Benchmark data	Known Best Solution		Scheme-1			
			Largest-Degree + Kempe + Pairswap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest-Degree	After Kempe	After Pairswap
CARF92	32	3.74	32	10.62	5.57	5.55
CARS91	35	4.42	34	11.50	7.32	7.30
KFU93	20	12.96	20	46.52	18.28	17.88
TRE92	23	7.75	23	15.90	10.47	10.38
YOR83	21	34.84	23	64.69	37.34	37.33

## 2.2 Scheme-2: Saturation Degree

Benchmark data	Known Best Solution		Scheme-2				
			Saturation-Degree + Kempe + Pairswap				
	Timeslots	Penalty	Timeslots	Penalty	After Largest-Degree	After Kempe	After Pairswap
CARF92	32	3.74	29		10.33	6.42	6.39
CARS91	35	4.42	31		13.74	7.98	7.93
KFU93	20	12.96	20		48.82	18.55	18.09
TRE92	23	7.75	22		16.32	11.06	10.90
YOR83	21	34.84	23		60.80	39.30	39.26

## 2.3 Scheme-3: Largest Enrollment

Benchmark data	Known Best Solution		Scheme-3			
			Largest-Enrollment + Kempe + Pairswap			
	Timeslots	Penalty	Timeslots	Penalty		
				After Largest-Degree	After Kempe	After Pairswap
CARF92	32	3.74	35	10.7	5.25	5.16
CARS91	35	4.42	36	13.78	6.72	6.67
KFU93	20	12.96	21	54.51	17.66	17.45
TRE92	23	7.75	22	16.33	10.53	10.51
YOR83	21	34.84	25	63.27	33.47	33.42

## 2.4 Scheme-4: Random Ordering

Benchmark data	Known Best Solution		Scheme-4			
			Random-Ordering + Kempe + Pairswap			
	Timeslots	Penalty	Timeslots	Penalty		
After Largest-Degree				After Kempe	After Pairswap	
CARF92	32	3.74	41	8.07	4.52	4.46
CARS91	35	4.42	46	9.07	5.13	5.06
KFU93	20	12.96	24	38.43	15.00	14.63
TRE92	23	7.75	26	12.37	9.08	8.97
YOR83	21	34.84	27	51.66	31.67	31.62

## 2.5 Scheme-5: Largest Degree (with linear penalty)

Benchmark data	Known Best Solution		Scheme-1			
			Largest-Degree + Kempe + Pairswap			
	Timeslots	Penalty	Timeslots	Penalty		
				After Largest-Degree	After Kempe	After Pairswap
CARF92	32	3.74	32	6.76	3.79	3.77
CARS91	35	4.42	34	7.40	4.60	4.57
KFU93	20	12.96	20	28.73	12.80	12.64
TRE92	23	7.75	23	10.14	6.80	6.75
YOR83	21	34.84	23	40.76	24.96	24.86

## 3 Discussion

For the perturbative heuristics, total 1000 iterations are performed. It can be observed that, regardless of how much we increase the number of iterations, at one point the penalty gets saturated, i.e., cannot go below certain threshold. From the constructive heuristics, using the **Largest Degree heuristic**, we get almost similar timeslot results with the known best solutions.

Using **Saturation Degree heuristic** lessened the time slots but also increasing penalty in the process

**Largest enrollment heuristic** helps mitigate the penalty but increases time slots.

With **Random Ordering**, we get the lowest penalty of all the schemes, however it also causes the time slots to be the largest.

To sum up, different heuristics result in different results and each tries to follow specific constraints.

Overall, the largest degree heuristic gave us the most optimal solution considering both hard scheduling and soft penalty.