Report on Offline 03: Local Search

#1805040

Dataset for Exponential Strategy

Scheme-1:

Benchmark Data	Known Best Solution		Scheme-1 Largest Degree + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	32	10.62	6.03	5.57
car-s-91	35	4.42	34	11.50	7.72	7.28
kfu-s-93	20	12.96	20	46.52	20.15	17.13
tre-s-92	23	7.75	23	15.90	10.47	9.89
yor-f-83	21	34.84	23	64.69	39.30	37.84

Scheme-2:

Benchmark Data	Known Best Solution		Scheme-2 Saturation Degree + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	30	9.69	6.51	5.99
car-s-91	35	4.42	31	12.45	8.68	8.26
kfu-s-93	20	12.96	19	46.70	20.65	18.15
tre-s-92	23	7.75	23	15.92	11.02	10.27
yor-f-83	21	34.84	20	61.66	46.81	45.77

Scheme-3:

Benchmark Data	Known Best Solution		Scheme-3 Largest Enrollment + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	35	10.69	5.42	4.86
car-s-91	35	4.42	36	13.78	7.18	6.77
kfu-s-93	20	12.96	21	54.51	18.68	15.26
tre-s-92	23	7.75	22	16.33	10.82	10.44
yor-f-83	21	34.84	25	63.27	34.81	32.85

Scheme-4:

Benchmark Data	Known Best Solution		Scheme-4 Random Ordering + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	44	7.69	4.00	3.46
car-s-91	35	4.42	46	9.38	5.34	4.77
kfu-s-93	20	12.96	26	34.74	13.53	11.15
tre-s-92	23	7.75	30	13.94	6.98	6.30
yor-f-83	21	34.84	27	49.42	31.76	30.05

Dataset for Linear Strategy

Scheme-1:

Benchmark Data	Known Best Solution		Scheme-1 Largest Degree + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	32	6.76	3.59	3.34
car-s-91	35	4.42	34	7.40	4.64	4.38
kfu-s-93	20	12.96	20	28.73	11.64	10.53
tre-s-92	23	7.75	23	10.14	5.93	5.71
yor-f-83	21	34.84	23	40.76	24.53	23.96

Scheme-2:

Benchmark Data	Known Best Solution		Scheme-2 Saturation Degree + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	30	6.28	3.72	3.52
car-s-91	35	4.42	31	8.05	4.98	4.74
kfu-s-93	20	12.96	19	28.99	14.25	12.66
tre-s-92	23	7.75	23	10.13	5.95	5.73
yor-f-83	21	34.84	20	38.92	28.98	28.78

Scheme-3:

Benchmark Data	Known Best Solution		Scheme-3 Largest Enrollment + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	35	6.73	3.17	2.96
car-s-91	35	4.42	36	8.85	4.26	4.05
kfu-s-93	20	12.96	21	34.24	10.80	9.77
tre-s-92	23	7.75	22	10.43	6.19	5.91
yor-f-83	21	34.84	25	40.24	21.47	20.90

Scheme-4:

Benchmark Data	Known Best Solution		Scheme-4 Random Ordering + Kempe Chain + Pair Swap			
			Timeslots	Penalty		
	Timeslots	Penalty		After Largest Degree	After Kempe Chain	After Pair Swap
car-f-92	32	3.74	44	4.95	2.30	2.04
car-s-91	35	4.42	48	6.06	2.88	2.61
kfu-s-93	20	12.96	25	23.06	8.65	7.36
tre-s-92	23	7.75	28	8.45	4.64	4.41
yor-f-83	21	34.84	29	31.57	17.65	17.01

Analysis:

From the dataset, we see that in almost all benchmarks the second scheme ie scheduling using **Saturation Degree** requires the least number of time slots. However, when we take penalties into account, this scheme performs the worst. The fourth scheme ie scheduling by **Random Ordering** suffers the least penalty, followed by the third scheme ie scheduling by courses with **Largest Enrollment.**

A deeper analysis shows that the saturation degree scheme requires **26%** to **33%** less timeslots that random ordering, and **10%** to **20%** less timeslots than largest enrollment scheme. In terms of penalties incurred, it incurs **50%** to **100%** more than random ordering, and **20%** to **40%** more than largest enrollment.

Conclusion:

Since reducing timeslots is the primary objective, **the saturation degree scheme is the best**, unless maintaining maximum days between two exams for the students is almost as important as reducing the timeslots. In the later case, **the largest enrollment scheme should be used**, since by nature the random ordering is unpredictable and may provide poor outcome.