

Optimizing & Scheduling of Examination Dates

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Supervised by : Prof Dr Frank Michael Schlieff

Input Files for THWS(FIW-Computer Science & Business Informatics):

Student ID	Course Co
5722663	5000130
5722689	5000130
5722686	5000130
5722685	5000130
5722684	5000130
5722683	5000130
5722680	5000130
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5722675	5000130
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5722610	5000130
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5722601	5000130
5722600	5000130
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5722596	5000130
5722595	5000130
5722594	5000130
5722593	5000130
5722591	5000130

5100350	Algebra
5101110	Algorithm
5171020	Artificial In
5100820	English for
5000440	Grundlage
5003020	Mathematik
5071054	Angewandte
5100360	Analysis
5002130	Business S
5100430	Angewandte
5100020	Algorithm
5000420	Grundlage
5071038	Ausgewähl
5102300	Beitragssy
5003188	Blockchair
5003130	Autonomie
6102110	Content E
5101200	Datenbank
5001310	Cloud Nati
5001310	Datenbank
5001310	Content V
5001820	Business T
5101802	Defensive
5101910	Datenkern
5081040	Digital Tr
5000430	Grundlage
5000910	English for
5003803	Entwicklun
5101740	Datenbank
5000510	Grundlage
5100720	Grundlage
5100620	Grundlage
5003000	IT-Organis
5003230	IT-Projekt
5003005	IT-Riskm
5101010	Grundlage
5000730	Innovator
5003199	Linux/UNIX
5002030	Marketing
6100310	Mathemat
5003220	Informatic
5081030	Ethical Lea
5000340	Mathemat
5001710	Logistik
6100320	Mathemat
5100420	Mathemat
5100333	Logistik
6102210	Online-Ma
5000350	Mathemat
6102310	Oberfläch
5100240	Programm
5171512	Cloud Nati
5003065	Online-Ma
5000130	Programm
5102110	Rechnung
5101220	Programm
5102110	Software f
5001010	Software
5171210	Software
5002212	Vertiefung
5000310	Rechnung
5003143	Shopware
5107201	Software
5101820	Rechnerar
5074130	Verteil S
6101810	Statistik
5004010	Statistik u
5101400	Statistik
5104211	Vertiefung
5081504	Web-Cont
6104201	Vertiefung
5108100	Vertiefung
5104310	Vertiefung
5171010	Mathemat
5003189	Videocont
5100120	Web-Prob
5002810	Wirtschaft
5171070	Trustwort
5077220	Wissensch

Index	Rooms	Room Cap	RoomType
0	H.1.1	63	Lecture Ha
0	H.1.2	31	Lecture Ha
0	H.1.3	32	Lecture Ha
0	H.1.6	24	Lecture Ha
0	H.1.7	24	Lecture Ha
1	I.2.15	16	Seminar R
1	I.3.19	16	Seminar R
1	I.3.20	27	Seminar R
1	I.3.24	16	Seminar R
1	H.1.11	15	Seminar R
2	I.2.1	10	Room
2	I.2.15a	12	Room
2	I.2.18/19	18	Room

Exam Registration File

Course File

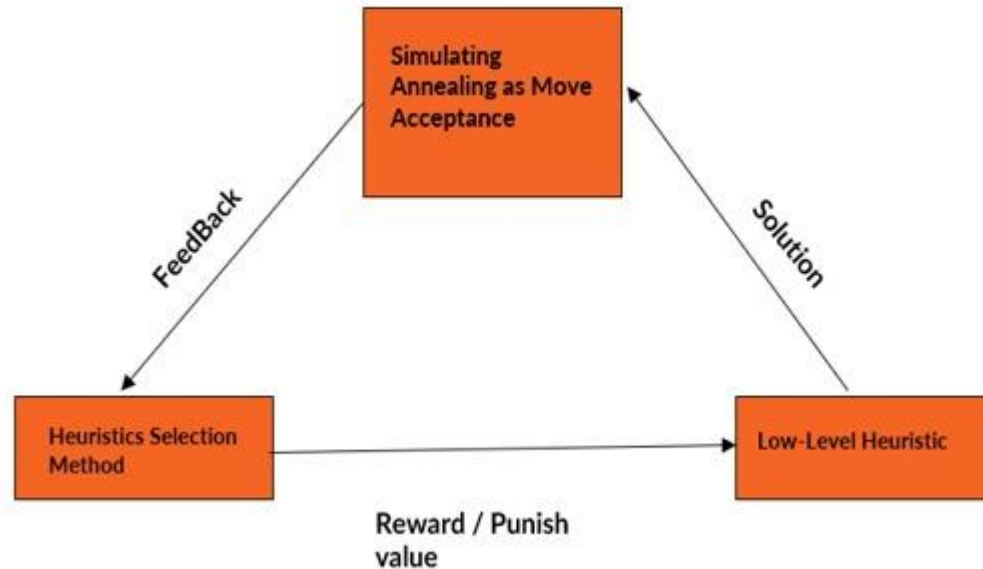
Room File



3 Approaches



Reinforcement Learning Simulated Annealing Hyper heuristic Framework



Results

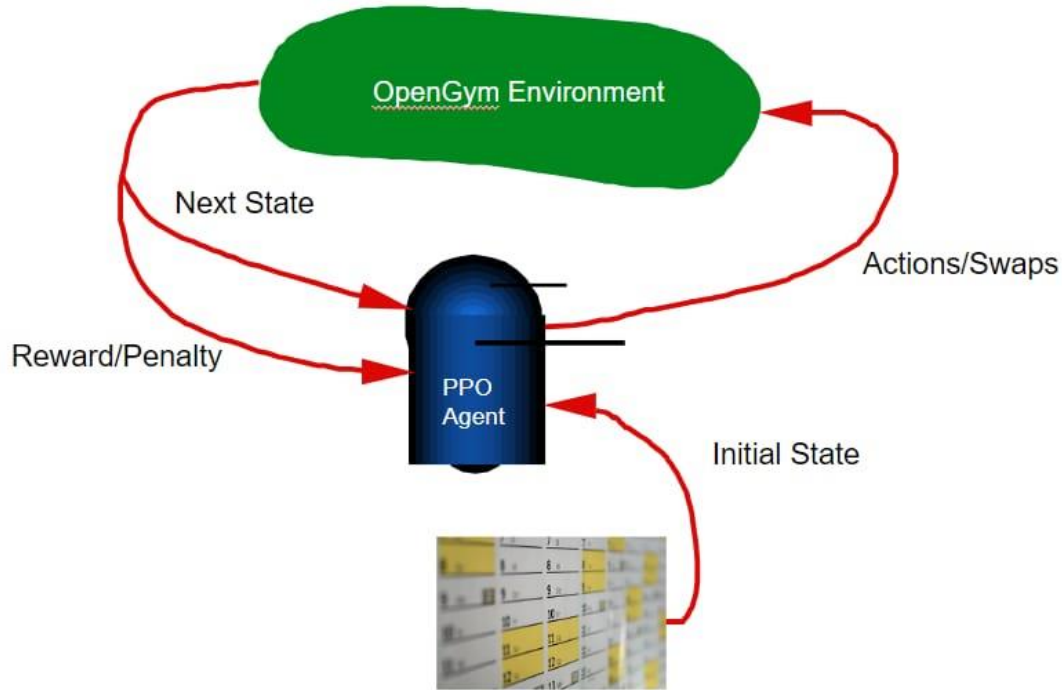
```
Soft Constraints Violation 9

Hard Constraints:
1: An exam will be scheduled for each course ✓
2: A student can not give more than one exam at a time ✗
3: All exams must be held between 9 AM and 5 PM ✓
4: The capacity of the exam should not exceed the room capacity. ✓
5: No exam scheduled in the same room at the same time ✗
6: No exams are scheduled in Saturdays and Sundays ✗
7: No invigilator invigilating exams at the same time ✗

Soft Constraints:
1: An exam will be scheduled for each course ✓
2: Two exams in a row: minimize student sitting consecutive exams in a consecutive days. ✗ 442
3: One hours of break for faculty meeting ✓
4: Two exams in a day: minimize student sitting more than two exams in a day. ✓
5: Period penalty: minimize the number of exams scheduled in the period with a penalty. ✓
6: Room penalty: minimize the number of exams scheduled in a room with a penalty. ✗
7: Larger examination schedule late in the timetable: minimize the number of large exams that appear 'late' in the timetable. ✗

Hard Constraints Violations 90
Soft Constraints Violation 9
```

Reinforcement Learning PPO Framework



Results

Exam Timetable Generator for Technical University of Applied Sciences Würzburg-Schweinfurt

Number of Days:

20

Number of Time Slots:

4

Upload Exam Registration File

Upload Room Data File

Upload Course Data File

Generate Initial Schedule as PDF

Check Constraints

H1 A student cannot sit more than one exam at the same time: 0 violations

H2 The capacity of the exam should not exceed the room capacity: 0 violations

H3 No exam scheduled in the same room at the same time : 0 violations

H4 No duplicate courses are scheduled: 0 violations

S1 minimize student sitting consecutive exams on the same day: 0 violations

S2 minimize student sitting consecutive exams in consecutive days: 2588 violations

S3 When an exam is split between multiple rooms, all those exams are scheduled at the same timeslot: 0 violations

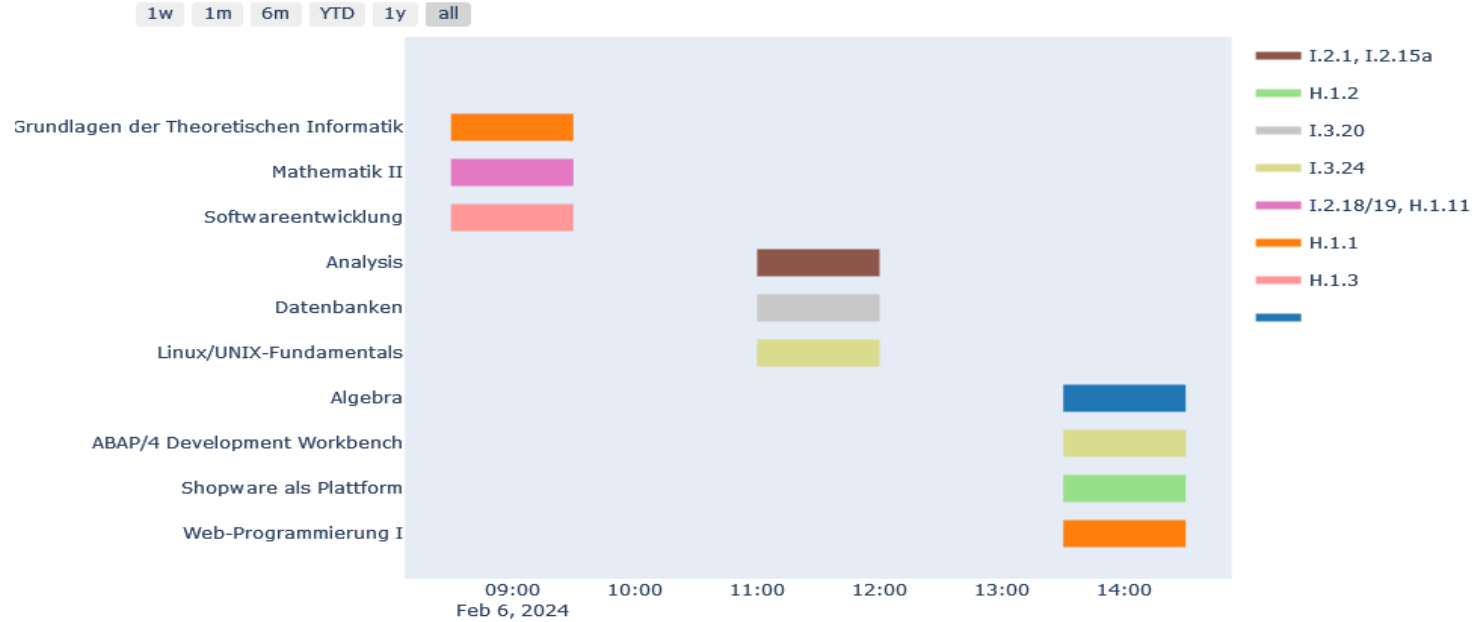
S4 Exams with higher registrations are scheduled first: 0 violations

Exam Schedule

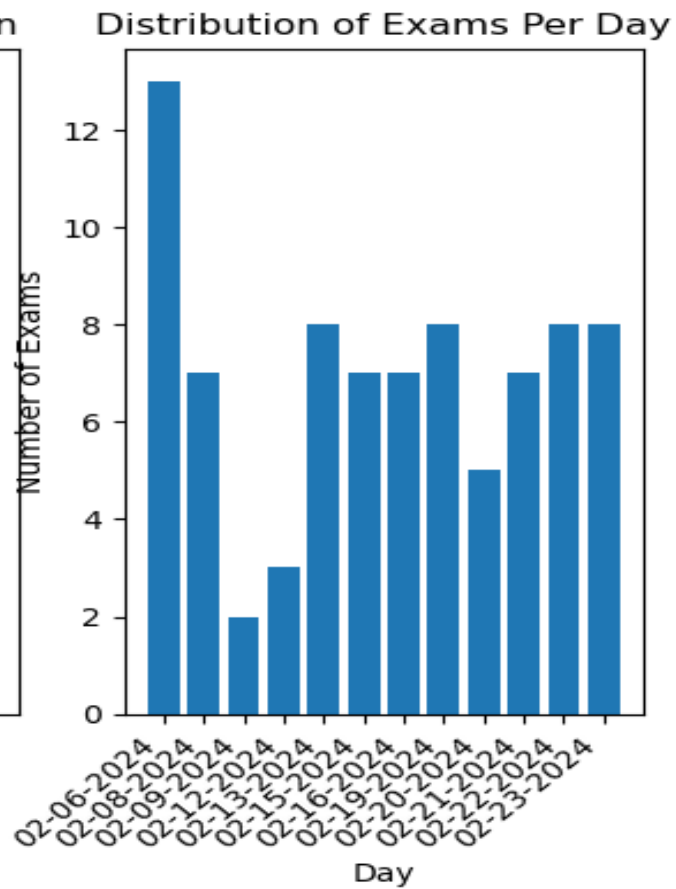
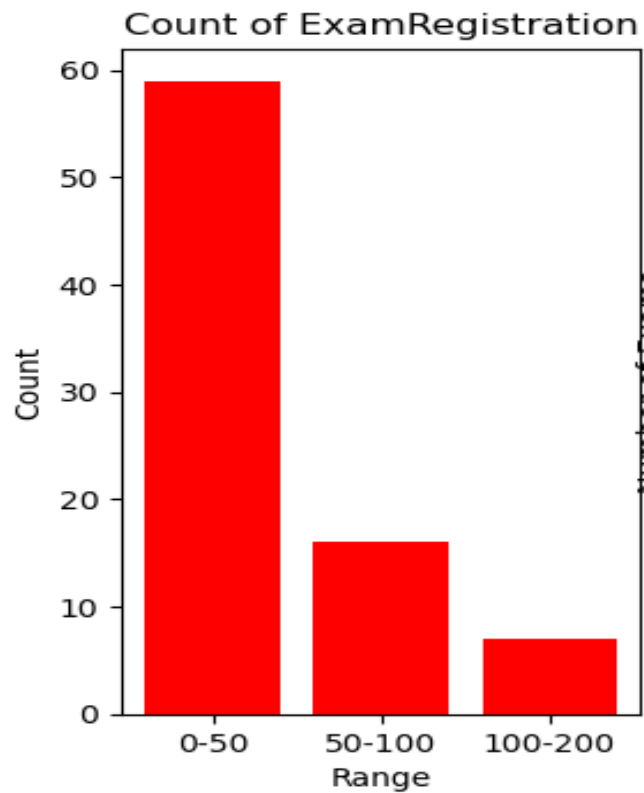
Day	Time Slot	Room Name	Course Name
Monday(1/29)	8:00 - 10:00	H.1.1	Algorithmen und Datenstrukturen I [5100020]
Monday(1/29)	8:00 - 10:00	H.1.2	Algorithmen und Datenstrukturen I [5100020]
Monday(1/29)	8:00 - 10:00	H.1.3	Algorithmen und Datenstrukturen I [5100020]
Monday(1/29)	8:00 - 10:00	H.1.6	Algorithmen und Datenstrukturen I [5100020]
Monday(1/29)	8:00 - 10:00	H.1.7	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	I.2.15	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	I.3.19	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	I.3.20	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	I.3.24	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	H.1.11	English for E-Commerce [6100820]
Monday(1/29)	8:00 - 10:00	I.2.1	English for E-Commerce [6100820]
Monday(1/29)	11:00 - 13:00	H.1.1	Vertiefung 2 CO: Quantitative und qualitative Nutzerforschung 2023 [6106202]
Monday(1/29)	11:00 - 13:00	H.1.2	Softwarearchitekturen [5081010]
Monday(1/29)	11:00 - 13:00	H.1.3	Vertiefung 2 BS: Tools für Business Software [5004202]
Monday(1/29)	11:00 - 13:00	H.1.6	Vertiefung 2 IS: Information Security Management [5104212]
Monday(1/29)	11:00 - 13:00	H.1.7	Trustworthy AI and AI Regulations [5171070]
Monday(1/29)	14:00 - 16:00	H.1.1	Vertiefung II SmS: Internet of Things [5105213]
Monday(1/29)	14:00 - 16:00	H.1.2	Vertiefung II WM: Traffic-Management und Website Optimierung [6104201]
Monday(1/29)	14:00 - 16:00	H.1.3	IT-Projektmanagement [5103220]
Monday(1/29)	14:00 - 16:00	H.1.6	Content Engineering [6102110]
Monday(1/29)	14:00 - 16:00	H.1.7	Vertiefung 2 BT: Business Process Management [5005202]
Monday(1/29)	15:00 - 17:00	H.1.1	Vertiefung II MI: Digitale Medien- und Multimedia-Techniken [5107201]
Monday(1/29)	15:00 - 17:00	H.1.2	Vertiefungsseminar SHS [6108100]
Monday(1/29)	15:00 - 17:00	H.1.3	Verteilte Systeme [5074130]
Monday(1/29)	15:00 - 17:00	H.1.6	5101310 [5101310]
Monday(1/29)	15:00 - 17:00	H.1.7	5000720 [5000720]
Tuesday(1/30)	8:00 - 10:00	H.1.1	Agile Enterprise - Agile Methoden in der Praxis [5003123]
Tuesday(1/30)	8:00 - 10:00	H.1.2	Logistikmanagement im E-Commerce [5003133]
Tuesday(1/30)	8:00 - 10:00	H.1.3	Das Recht herausgefordert durch technische Neuerungen [5003190]
Tuesday(1/30)	8:00 - 10:00	H.1.6	Theoretische Informatik [5074210]
Tuesday(1/30)	8:00 - 10:00	H.1.7	Mathematische Software in der Informatik [5100420]
Tuesday(1/30)	11:00 - 13:00	H.1.1	Grundlagen der Technischen Informatik [5100720]
Tuesday(1/30)	11:00 - 13:00	H.1.2	Grundlagen der Technischen Informatik [5100720]

Genetic Algorithm

Exam Schedule

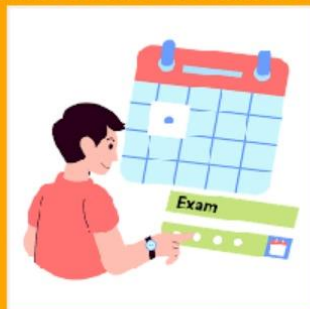


Gantt Chart



THWS University Semester Exam Schedule

FIW-Computer Science & Business Informatics



Upload files

Upload Courses

Courses upload successful!

Upload Rooms

Rooms upload successful!

Upload Exam Registrations

Exam Registrations upload successful!

Generate the Exam Schedule

Exit

Results

THWS University Semester Exam Schedule Winter

FIW-Computer Science & Business Informatics



Download Exam Schedule as PDF

Hard Constraints:

- 1: An exam will be scheduled for each course ✓
- 2: A student can not give more than one exam at a time ✓
- 3: All exams must be held between 9 AM and 5 PM ✓
- 4: The capacity of the exam should not exceed the room capacity. ✓
- 5: No exam scheduled in the same room at the same time ✓
- 6: No exams are scheduled in Saturdays and Sundays ✓

Soft Constraints:

- 1: An exam will be scheduled for each course ✓
- 2: Two exams in a row: minimize student sitting consecutive exams in a consecutive days. ✗ 208 violations
- 3: One hours of break for faculty meeting ✓
- 4: Two exams in a day: minimize student sitting more than two exams in a day. ✓
- 5: Period penalty: minimize the number of exams scheduled in the period with a penalty. ✓
- 6: Room penalty: minimize the number of exams scheduled in a room with a penalty. ✓
- 7: Larger examination schedule late in the timetable: minimize the number of large exams that appear 'late' in the timetable. ✓

Exit

Exam Schedule

Date	Time	Subject	Subject Code	Room No
06-FEB-2024 Tuesday	08:30	Grundlagen der Theoretischen Informatik	5101010	I.3.20, H.1.7, H.1.6
06-FEB-2024 Tuesday	11:00	Grundlagen Informatik	5000440	H.1.1, H.1.11, I.2.18/19
06-FEB-2024 Tuesday	11:00	Business Technologies	5001820	H.1.2
06-FEB-2024 Tuesday	13:00	Betriebssysteme	5102200	H.1.7, I.3.24, H.1.3
06-FEB-2024 Tuesday	13:00	Vertiefung II SmS: Internet of Things	5105213	I.3.20
06-FEB-2024 Tuesday	16:00	Grundlagen Informatik und E-Commerce	5000420	H.1.1
06-FEB-2024 Tuesday	16:00	Innovationsmanagement und Unternehmensgründung	5000730	I.3.19, H.1.3, I.2.15, I.2.1
06-FEB-2024 Tuesday	16:00	Vertiefung I IS: IT-Sicherheit	5104211	I.3.20
08-FEB-2024 Thursday	08:30	Angewandte Numerik	5100430	I.2.18/19
08-FEB-2024 Thursday	08:30	IT-Organisation und IT-Controlling	5001900	H.1.2, I.3.19, I.2.15a, I.2.15
08-FEB-2024 Thursday	11:00	Grundlagen der Betriebswirtschaftslehre	5100620	I.3.20
08-FEB-2024 Thursday	11:00	Rechnungswesen	6102010	H.1.6, I.2.15a, H.1.2, I.3.19
08-FEB-2024 Thursday	13:00	Cloud Native Enterprise Java	5003804	H.1.2
08-FEB-2024 Thursday	13:00	Statistik und Operations Research	5001610	I.3.19, I.2.15a, H.1.11
08-FEB-2024 Thursday	16:00	Algorithmen und Datenstrukturen I	5100020	I.3.19, H.1.1, I.3.20, I.3.24, H.1.6
13-FEB-2024 Tuesday	08:30	IT-Projektmanagement	5003230	I.3.24, H.1.7, I.2.1, I.2.15a
13-FEB-2024 Tuesday	08:30	Programmierprojekt	5100240	I.3.19
13-FEB-2024 Tuesday	08:30	Vertiefung II MS: Mobile and Ubiquitous Design	5007212	H.1.6, I.2.15
13-FEB-2024 Tuesday	11:00	Grundlagen der Technischen Informatik	5100720	I.2.15, H.1.2, H.1.1, I.2.15a, I.3.19



Thank You