TIGEN

Presentation For Final Year Project
United Institute of Technology,Prayagraj

Department of Computer Science and Engineering

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Introduction

TIGEN

Tigen is a Timetable Scheduler which works on genetic algorithm which is a part of evolutionary searching and optimization based problem grasped from biological terms.

Problem Statement

- Planning timetable is one of the most complex and error-prone task
- Scheduling problem that appears to be a tedious job in every institution
- Our college was continuously updating timetable hence we get this idea and tried to automate this task by developing TIGEN

Existing Solutions

- Manual Scheduling of timetable.
- Schedulers developed by considering their entities requirements

Examples

- pranavkhurana / Time-table-scheduler
- Baksonator / evolutionary-timetable-scheduling
- sukrutrao / Timetabler (using MaxSAT solver)

- Schedulers working on fixed data

Examples

- antoninkriz / CTU-TimeTableGenerator
- Sylvia23 / timetable-generator

Proposed Solution

- Core idea of TIGEN is to generate a non-conflicted Timetable
- Flexibility of Entities
- Provides user friendly environment
  - Terminal User Interface
  - Graphical User Interface
- Vector data structure is used for data storage.
- Version Control approach is used for analysing each build of the system.
- Cross-platform dependency is added

SDLC Models

Software developement life cycle refers to a methodology with clearly define processes for creating high quality software.

A number of different SDLC models are :-

- CLASSICAL WATERFALL MODEL - Idealistic model for small project,no availiability of feedback and rigid.
- ITERATIVE WATERFALL MODEL - Provides feedback paths but not good when requirements is not clear.
- SPIRAL MODEL - It is one of the most important SDLC which provides support mainly for risk handling.
- INCREMENTAL MODEL - It enforces Module by Module delivery.

SDLC Model Used

Agile SDLC model is used for developing TIGEN

AGILE Norms :

- Advance Methodology
- Model flexibility
- Parallel Developement
- Customer Involvement
- Promotes teamwork

Agile Stages

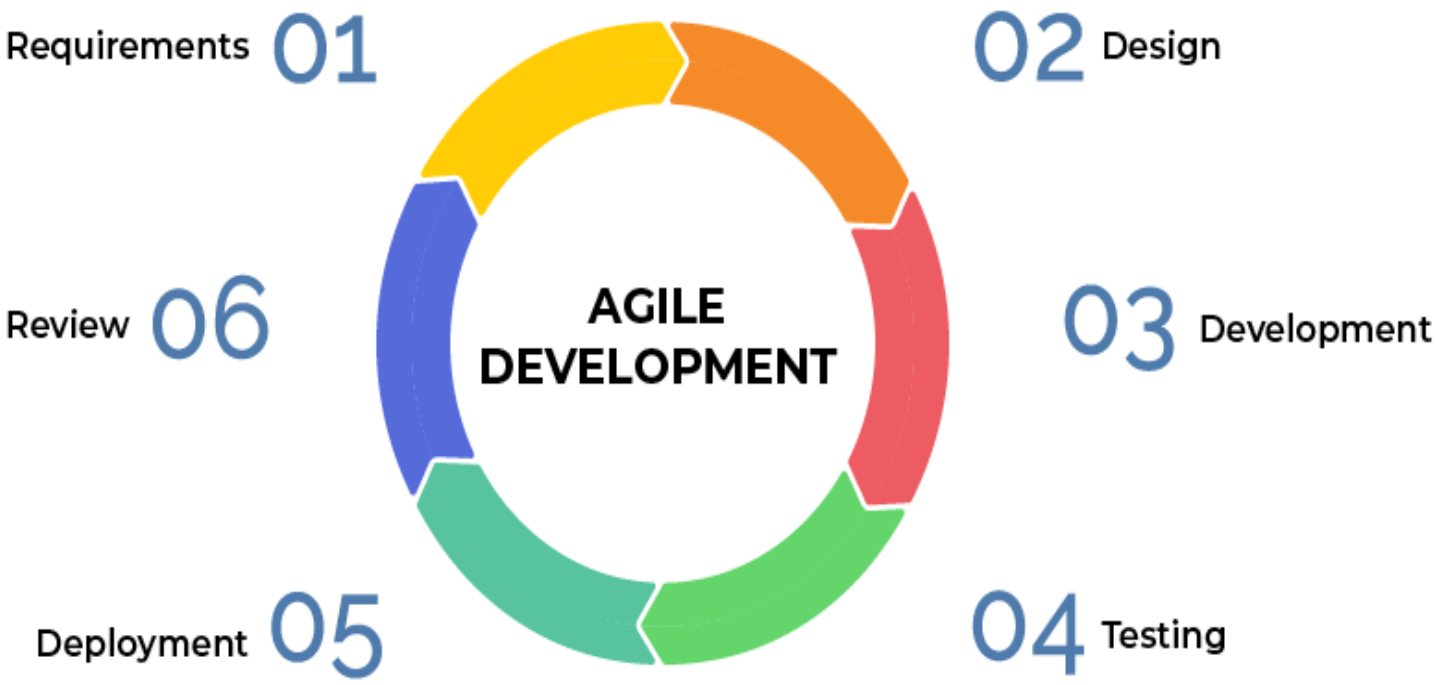


Figure: Stages of AGILE Model

Pros and Cons

PROS -

- Agile methodology is adaptive
- Suitable for fixed and change in requirements
- Test based approach to requirements and quality assurance
- It saves time
- Customer satisfaction is ensured

CONS -

- Difficult to scale projects where documents is essential
- More risk of sustainability, maintainbility and extensibility

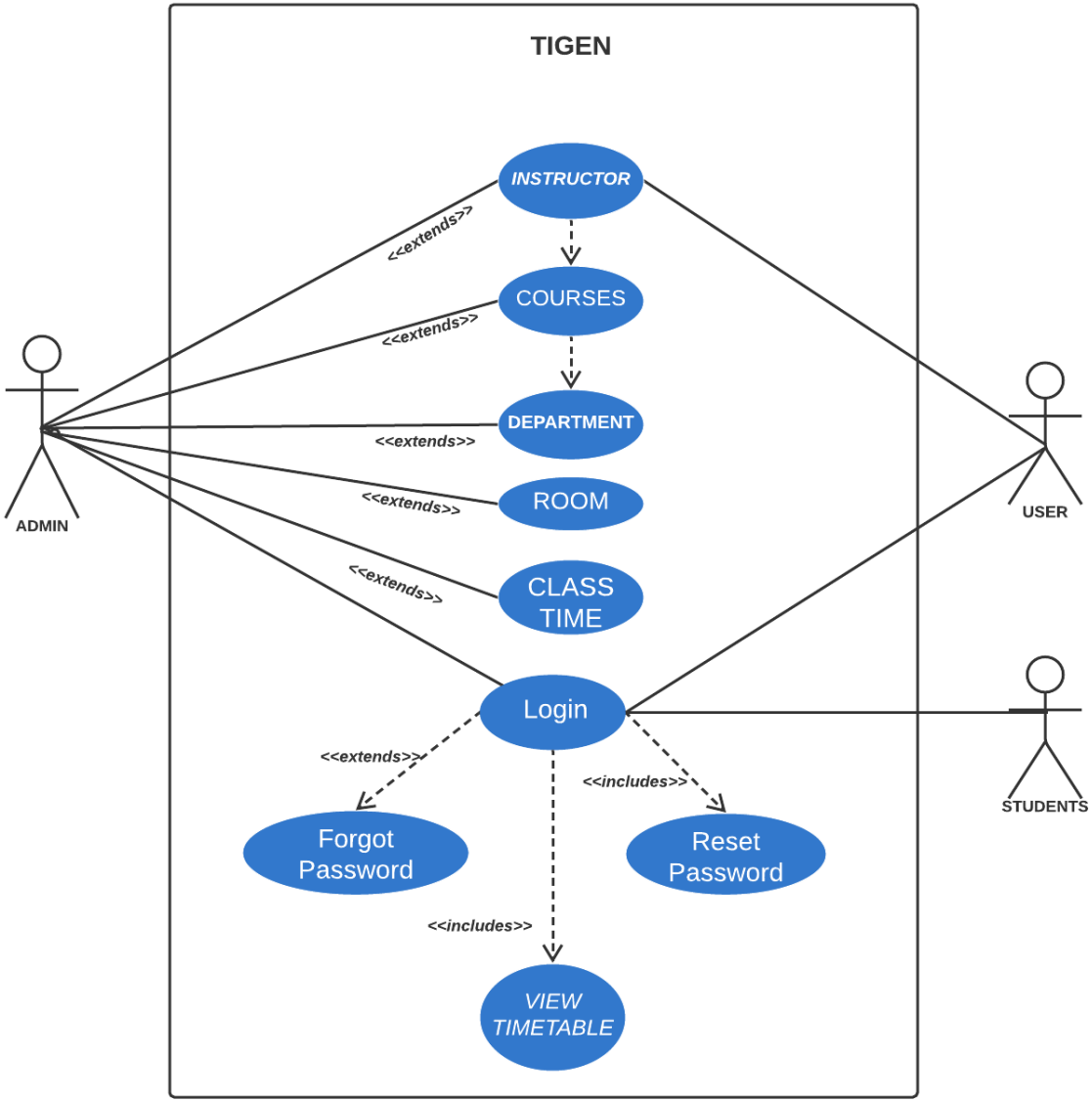
Technology and Libraries

- C++
- CMake Build Tool.
- C++ - Qt(for Graphical User Interface)
- C++ - ncurses/pdcurses(for Terminal User Interface)
- GIT (for version control)

Requirements

- Data Requirements
  - Minimum required data has to be provided.
  - Data should be structured properly.
- Functional Requirements
  - Data Input/Output.
  - Selection of Entities.
- Technical Requirements
  - GCC Compiler.
  - CMake build tool.
  - ncurses library.
- System Requirements
  - Windows or Linux/Unix Operating System.
  - Minimum 2 gigabytes RAM.

Design: Usecase Diagram



Design: Data Flow Diagram (LEVEL ZERO)

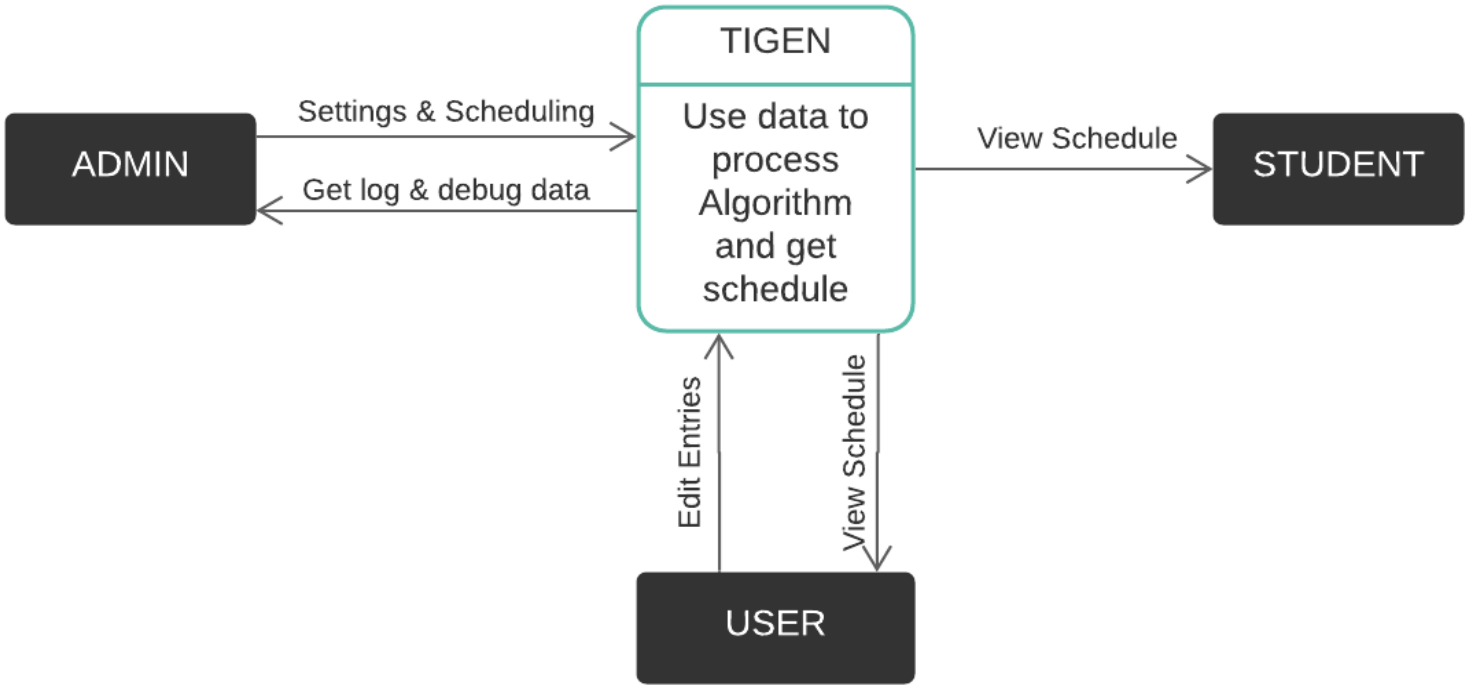


Figure: LEVEL ZERO DFD - TIGEN

Design: Data Flow Diagram (LEVEL ONE)

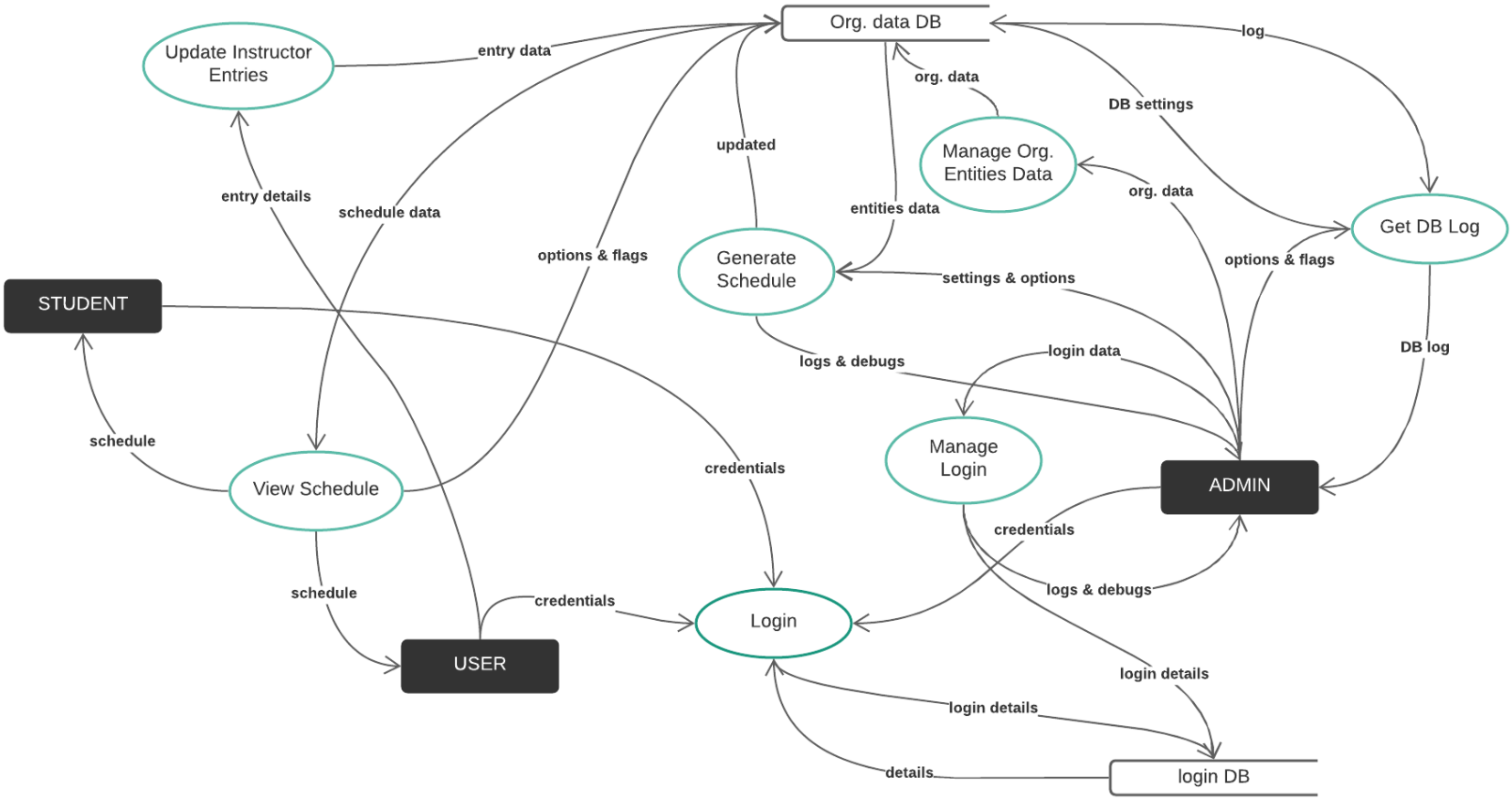
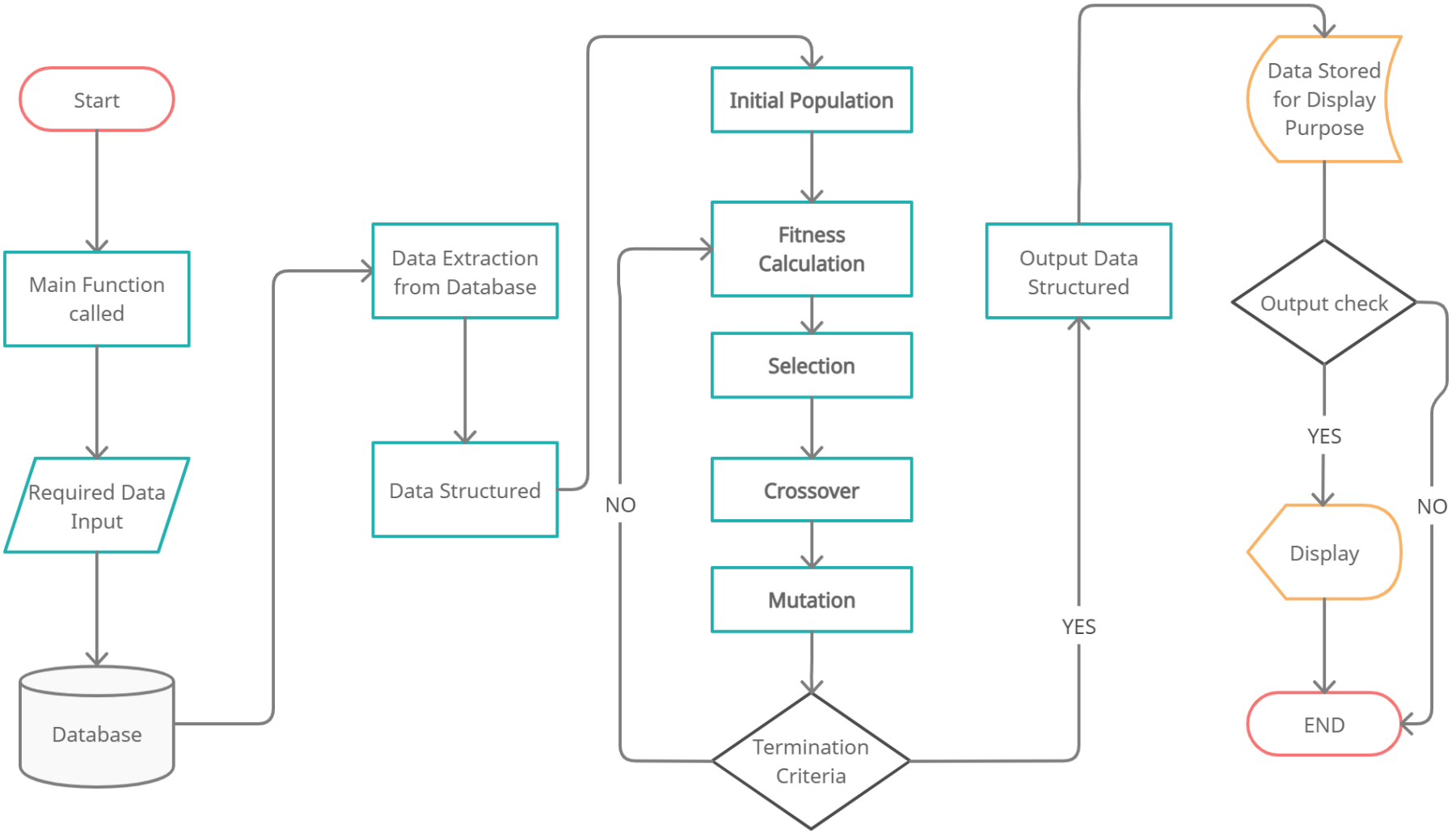


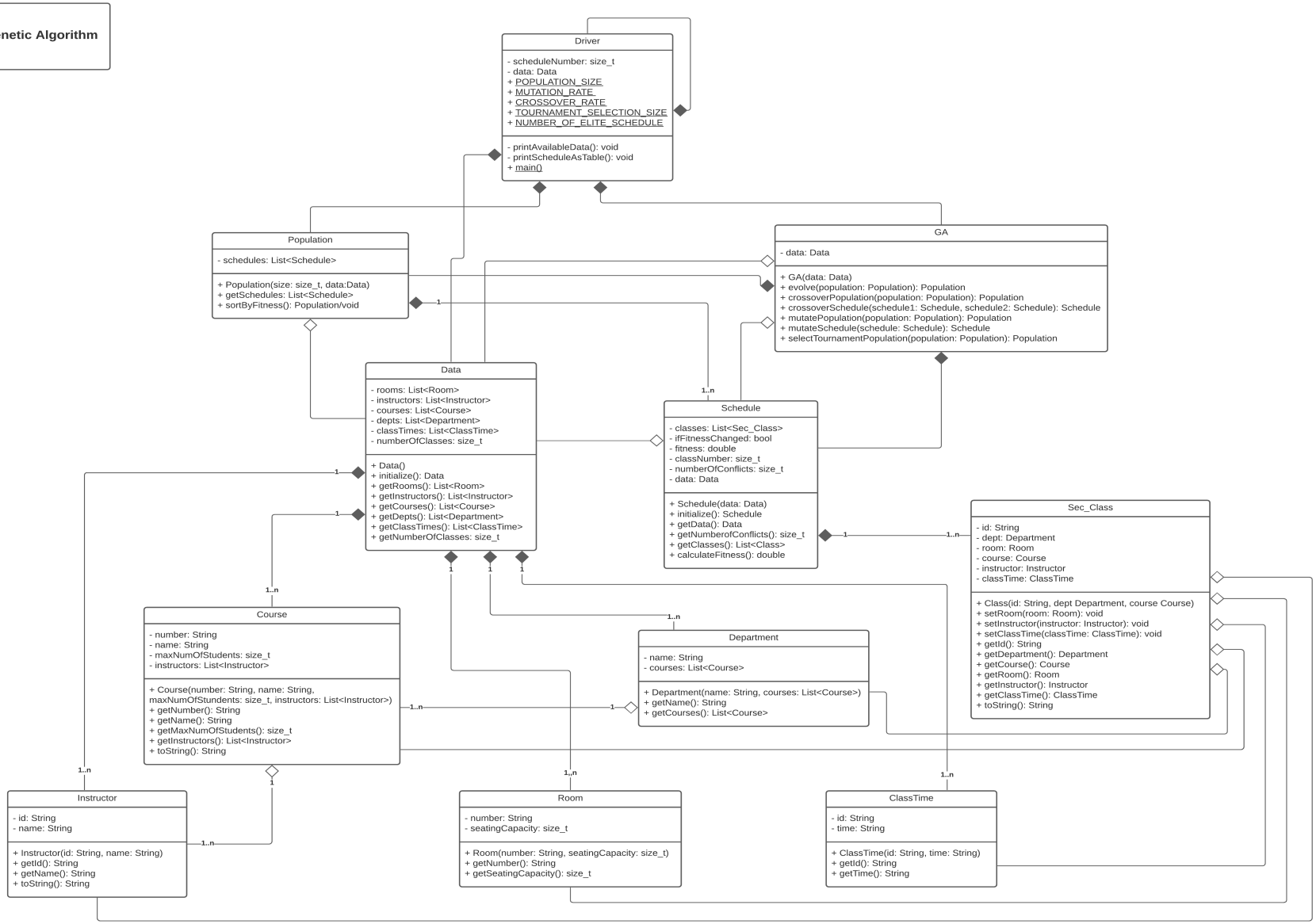
Figure: LEVEL ONE DFD - TIGEN

Design: Process Flow Chart



Design: Class Diagram

Class Diagram: Genetic Algorithm



Developement: Library

Types of Libraries C++ supports:

- Static Library (.a or .lib)
- Dynamic Library(.so or .dll)

Tigen generates two Dynamic libraries:

- tigen_lib - It contains the modules needed for algorithm.
- extras_lib - It contains extra utility modules for the system.

Developement: Data Encoding

- Data is encoded with proper MNEMONICS.
- Generates Initial population based on encoded data.
  - Population size = 9

MNEMONIC	DESCRIPTION
INST_ID	Instructor ID
NAME	Instructor Name

Figure: Instuctor table

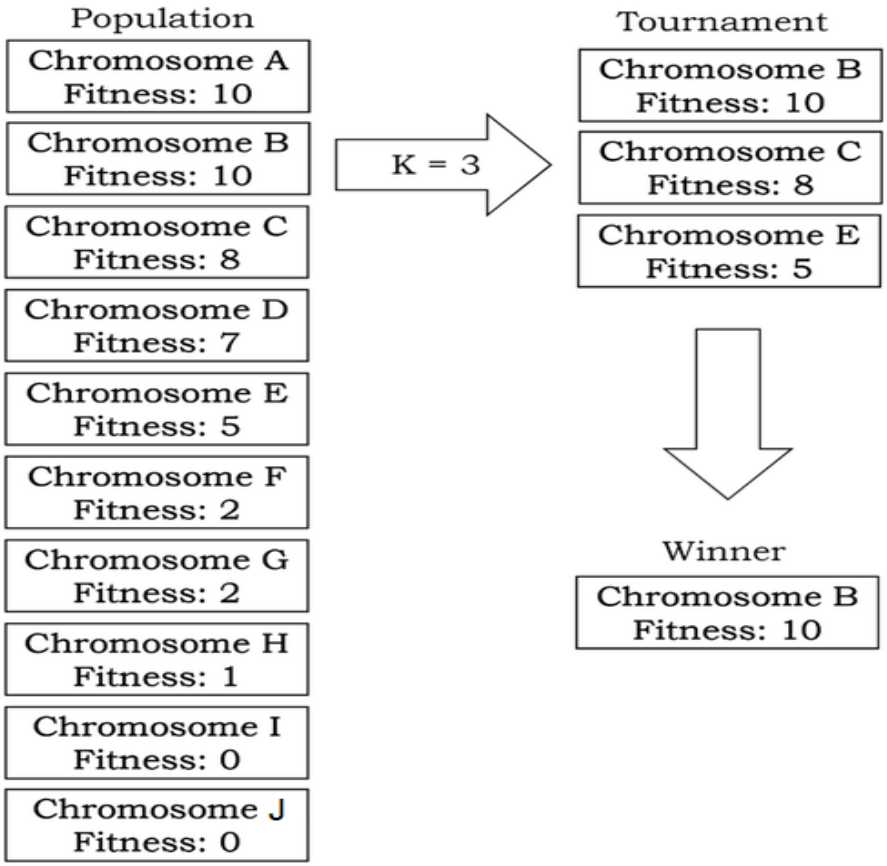
Developement: Operators

Genetic Operators Implementation :

- Fitness function is used to calculate fitness of the chromosomes.
- Selection operator is used to selector fittest chromosome from initial population.
- Crossover operator is used to create the offsprings from the parents chromosomes.
- Mutation operator is used to create diversity in the population.
- Termination Criteria is implemented to terminate the process when the optimal solution is generated.

Developement: Selection

- K - Tournament Selection Selects K chromosomes from Initial population.
- K is 3 in case of tigen
- Random selection from selected K chromosomes



Developement: Crossover

- Multipoint Crossover
- Combines genes of two parents to create childs.

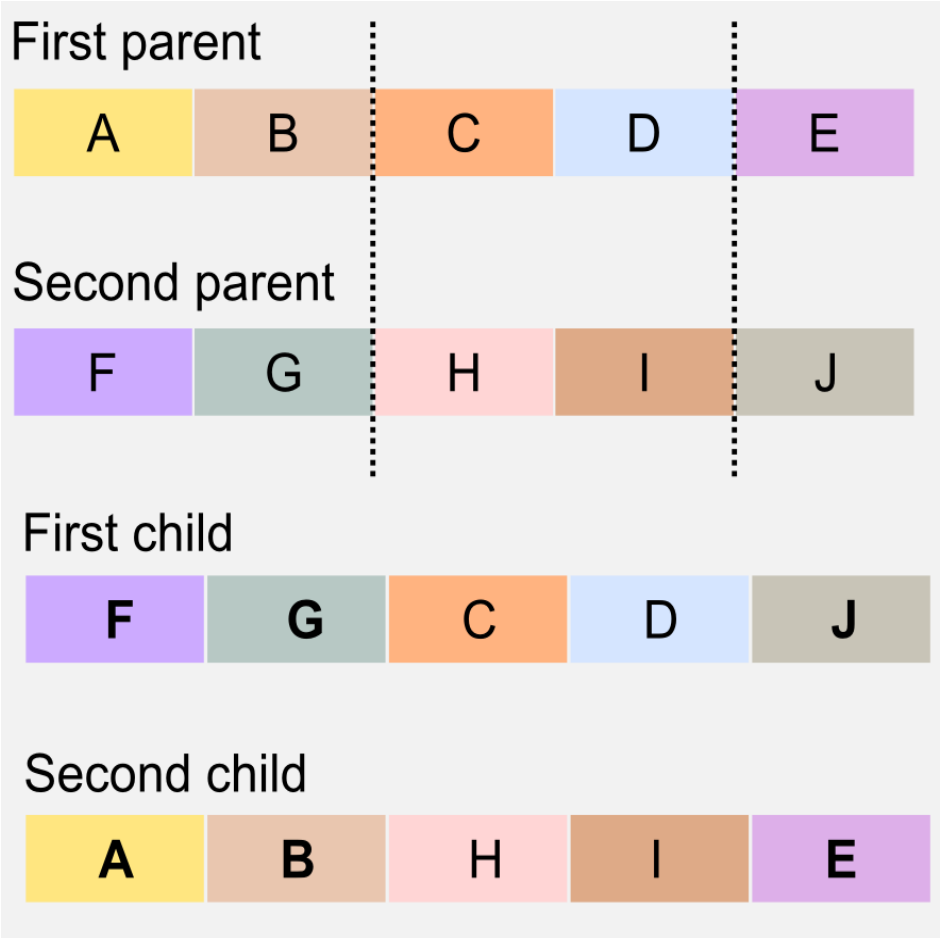


Figure: Multipoint Crossover

Developement: Mutation

- Scramble mutation
- It generates diversity in Initial population

Before Mutation

C	B	A	G	H	I	J	D	E	F

After Mutation

C	B	A	G	H	E	I	F	J	D

Figure: Scramble Mutation

Testing: Testcase 1

- Number of entities shown in Table 1 is provided as Input.

Table: 1

Entity Name	**Number**
Instructor	5
Courses	10
Department	2
Room	3
ClassTime	6

Testing: Testcase 1

- Result according to data provided in testcase 1.

Figure: Result for testcase 1

Testing: Testcase 2

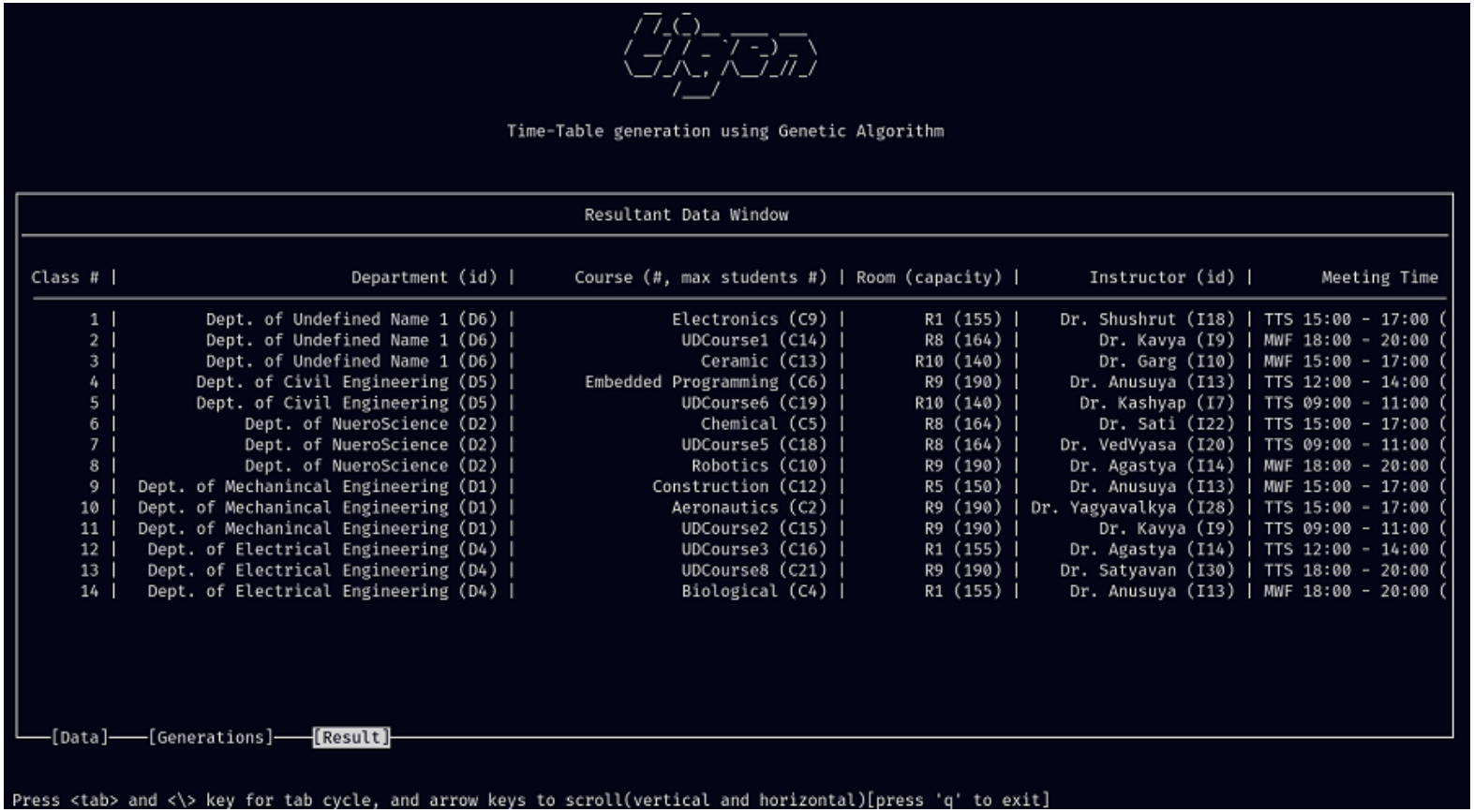
- Number of entities shown in Table 2 is provided as Input.

Table: 2

Entity Name	**Number**
Instructor	15
Courses	14
Department	5
Room	5
ClassTime	6

Testing: Testcase 2

- Result according to data provided in testcase 2.



Time-Table generation using Genetic Algorithm

Resultant Data Window

Class #	Department (id)	Course (#, max students #)	Room (capacity)	Instructor (id)	Meeting Time
1	Dept. of Undefined Name 1 (D6)	Electronics (C9)	R1 (155)	Dr. Shushrut (I18)	TTS 15:00 - 17:00 (
2	Dept. of Undefined Name 1 (D6)	UDCourse1 (C14)	R8 (164)	Dr. Kavya (I9)	MWF 18:00 - 20:00 (
3	Dept. of Undefined Name 1 (D6)	Ceramic (C13)	R10 (140)	Dr. Garg (I10)	MWF 15:00 - 17:00 (
4	Dept. of Civil Engineering (D5)	Embedded Programming (C6)	R9 (190)	Dr. Anusuya (I13)	TTS 12:00 - 14:00 (
5	Dept. of Civil Engineering (D5)	UDCourse6 (C19)	R10 (140)	Dr. Kashyap (I7)	TTS 09:00 - 11:00 (
6	Dept. of NueroScience (D2)	Chemical (C5)	R8 (164)	Dr. Sati (I22)	TTS 15:00 - 17:00 (
7	Dept. of NueroScience (D2)	UDCourse5 (C18)	R8 (164)	Dr. VedVyasa (I20)	TTS 09:00 - 11:00 (
8	Dept. of NueroScience (D2)	Robotics (C10)	R9 (190)	Dr. Agastya (I14)	MWF 18:00 - 20:00 (
9	Dept. of Mechanincal Engineering (D1)	Construction (C12)	R5 (150)	Dr. Anusuya (I13)	MWF 15:00 - 17:00 (
10	Dept. of Mechanincal Engineering (D1)	Aeronautics (C2)	R9 (190)	Dr. Yagyavalkya (I28)	TTS 15:00 - 17:00 (
11	Dept. of Mechanincal Engineering (D1)	UDCourse2 (C15)	R9 (190)	Dr. Kavya (I9)	TTS 09:00 - 11:00 (
12	Dept. of Electrical Engineering (D4)	UDCourse3 (C16)	R1 (155)	Dr. Agastya (I14)	TTS 12:00 - 14:00 (
13	Dept. of Electrical Engineering (D4)	UDCourse8 (C21)	R9 (190)	Dr. Satyavan (I30)	TTS 18:00 - 20:00 (
14	Dept. of Electrical Engineering (D4)	Biological (C4)	R1 (155)	Dr. Anusuya (I13)	MWF 18:00 - 20:00 (

[Data] [Generations] [Result]

Press <tab> and <\> key for tab cycle, and arrow keys to scroll(vertical and horizontal)[press 'q' to exit]

Figure: Result for testcase 2

Deployment

Tigen is deployed for testing it's cross-plateform functionalities on both Windows and linux environment in user's computer for the generation of timetable using the organization data.

Review

- TUI result is shown in figure

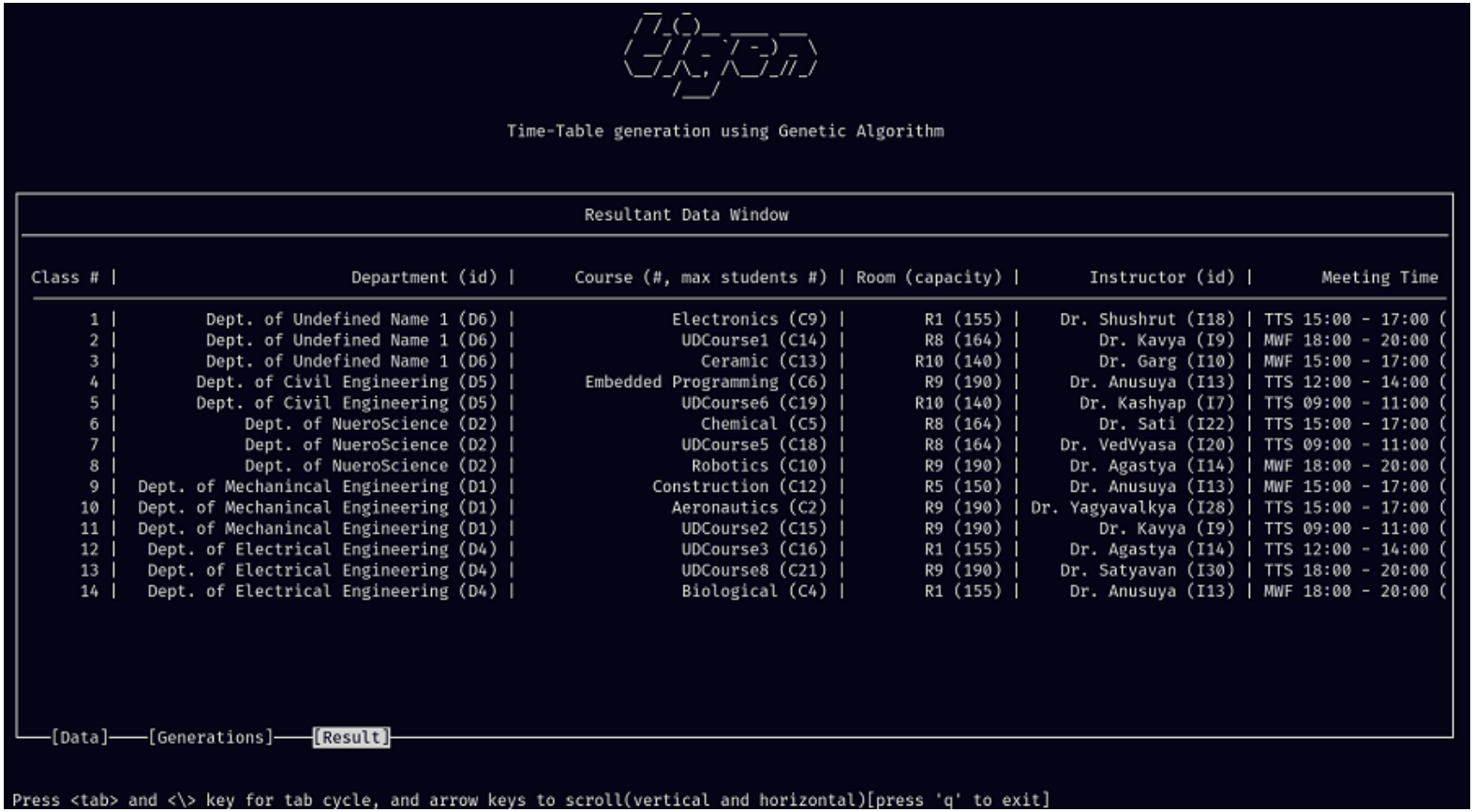


Figure: Terminal User Interface Result

Review

- Selection of courses is shown in Terminal user interface.

Figure: Terminal User Interface Instructor Selection

Review

- Selection of courses is shown in Terminal user interface.

Figure: Terminal User Interface Course Selection

Conclusion

- This system can give optimal results using less time than manual scheduling process.
- This system always generates a non-conflicted optimal solution in which all the given contraints is satisfied.
- This system has been developed to give error free results.
- Generation of timetable for an organization can be easier using this system.

Future Scope

Tigen model can be extended in several fields:

- Genetic Operators can be used to add more constraints to the algorithm.
- Hardware support can be added to tigen such that manpower can be minimized.
- Graphical User Interface features can be added for an user friendly enviroment

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Thank You!