SCHEDULING ACADEMIC PROCESSION IN UMP CONVOCATION CEREMONY USING HILL CLIMBING

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ABSTRAK

Perarakan akademik sudah menjadi satu acara wajib untuk Majlis Graduasi Universiti Malaysia Pahang (UMP). Pensyarah daripada semua fakulti akan terlibat untuk acara ini. Namun, tidak semua pensyarah akan terlibat kerana kekangan jubah yang tidak mencukupi. Thesis ini akan membandingkan tiga teknik yang boleh diguna pakai untuk penjadualan perarakan akademik di Majlis Graduasi UMP. Sebuah prototaip penjadualan yang menggunakan algoritma terpilih akan dibina. Thesis ini juga akan memberikan proses pelaksaan prototaip tersebut menggunakan algoritma terpilih. Hasil yang dikeluarkan daripada prototaip tersebut akan dibincangkan didalam thesis ini.

ABSTRACT

Academic assembly is one of the compulsory event in UMP Convocation Ceremony. Lecturers from all faculties in UMP will involve in the assembly. Since, there is limitation number of gown or hood, not all lecturers will be involved in the assembly. This thesis will differentiate three techniques that can be applied for scheduling Academic assembly in UMP Convocation Ceremony. A prototype will be develop based on the proposed algorithm. This thesis also provides the implementation process of the prototype and the proposed algorithm. The result that produced by the prototype will be compared with the old schedule.

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LIST OF ABBREVIATIONS

BPA	Academic Administrator Division
UMP	University Malaysia Pahang
UPKP	Unit Penerimaan & Kewangan Pelajar

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

University Malaysia Pahang (UMP) Convocation Ceremony is an event purposely to celebrate student academic achievement. The ceremony requires the student to wear formal gown. This ceremony held for three days which is Saturday, Sunday and Monday at UMP Sports Complex, Gambang campus. The certificates and transcripts can be collected from BPA, Gambang campus / Academic Administrator Division, Pekan campus after convocation ceremony ended. Letter of consent from owner of certificates and transcripts and copy of representative identity card is needed if the owner unable to take the certificates and transcripts by themselves.

There are five sessions in UMP Convocation Ceremony. Each graduate has one invitation card for their guests attend the ceremony. Date, time, and number of guests become the constrains for each session. As example, the first session for 12th UMP Convocation Ceremony is held from 8a.m until 12p.m on 18th November 2017. The number of guests for each graduate that involves in the first session is three guests.

12th UMP Convocation Ceremony held on 18th, 19th and 20th November 2017. UMP Expoconvo 2017 held on 16th until 20th November 2017. The rehearsal of 12th UMP Convocation Ceremony is held on 8. 30a.m, 17th November 2017 which require all the graduates to join.

There also a compulsory event in UMP Convocation Ceremony which is Academic Procession. This procession involved lecturers from all faculties in UMP. The capacity for lecturers involved in the procession for each session is determine by BPA. BPA also will provide the capacity for each faculty needed for the Academic Procession.

Each faculty will provide a list of lecturer name that will be involved in the Academic Procession based on the provided capacity.

1.2 PROBLEM STATEMENT

First problem for scheduling academic procession is there are limited number of convocation gown or hood for academic procession. There are only 353 gown or hood available for academic procession. For each session, the number of lecturers involved in academic procession would be different. As example, the first session requires 150 lecturers to involve in the procession while only 50 lecturers will be involved in second session. Hence, the lecturers will be scheduling to attend at least 2 out of 5 sessions or the maximum of 3 times out of 5 times. Moreover, there a lot of constraints in order scheduling the lecturers. For example, there must be at least one session gap between the involved sessions for each lecturer. This make it difficult to produce a solution for scheduling the gown or hood that satisfy all the constraints.

Second problem that happen during the scheduling academic procession is the lecturers does not involve in the procession but had register their name as attending. For an example, in the first session, the number of lecturer's register as attend is 150. The seats in the UMP Sports Complex, Gambang campus supposedly full but there are 10 empty seats. Why this happen during the academic assembly? It is because there is no centralized data to make sure there is no one can leave the UMP Convocation Ceremony until the ceremony is end. In addition, the lecturers going in, going out and change seat freely as there is no specific data to view the detail of involved lecturers. So, the approach for scheduling Academic Procession in UMP Convocation Ceremony would provide an optimum solution to make a reasonable schedule for all involved lecturers.

Based on two problem statements, the selected approach for scheduling the Academic Procession in UMP Convocation Ceremony will become a solution for the lecturers. The lecturer can have an enhance schedule for the Academic Procession in UMP Convocation Ceremony.

1.3 RESEARCH QUESTION

The research question that being the guidelines for this thesis is:

I. Can proposed algorithm produce an improvement schedule for the lecturers who involved in Academic Procession during Convocation Ceremony?

1.4 GOAL /AIM AND OBJECTIVE

The objectives of this thesis are:

I. To study which algorithm is suitable to produce an optimum schedule for lecturer that attend the academic assembly.

II. To implement proposed algorithm for Scheduling Academic Assembly in UMP Convocation Ceremony.

III. To evaluate the effectiveness of proposed algorithm in solving Scheduling Academic Assembly in UMP Convocation Ceremony.

1.5 SCOPE

The scopes of this thesis are:

I. The study focusses on real-world target datasets which is number of gown or hood and list name of involved lecturers in Academic Procession during 12^{th} UMP Convocation Ceremony.

II. The investigation focusses on three algorithms that might suitable for scheduling Academic Procession on UMP Convocation Ceremony.

III. Using Java language to develop the prototype for scheduling.

IV. The proposed algorithm is Hill Climbing.

1.6 REPORT/THESIS ORGANISATION

This thesis consists of five chapter. Introduction of Scheduling Academic Procession in UMP Convocation Ceremony will be discussed in chapter one. The problem statement, research question, objective and scope for the thesis also will be clearly stated in this chapter.

Next, all algorithms that suitable to be used to solve the problems will be compared in chapter two which is literature review. This research included about the pros and cons of the algorithms.

Chapter three is about methodology. This chapter will state the method used for the development of the system. List of hardware and software also will be listed in this chapter.

Chapter four will be discussing about the implementation, testing and result. The development environment, system functionality and the functionality testing will be discussed in this chapter.

Last but not least, chapter 5 will be discuss about the conclusion for this thesis. The constraint during the implementation process will be discuss. The future work will be included in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will describe the overview of scheduling. Three algorithms that considered to be used also included in this chapter. This comparison will explain in detail which are suitable to be adapted into this project to enhance scheduling Academic Procession in UMP Convocation Ceremony.

2.2 OVERVIEW OF SCHEDULING

Schedule is a plan of process for objective purposed with sources such as sequence of procedure and time allotted for each procedure to its completion. Besides, schedule is a series of stuff to be done or occur at or during a period. A written or printed statement of details creating an explanatory or appendix to another document is also definition of schedule. Schedule usually in classified or tabular form.

Scheduling meaning is to make an agenda or to organize activities for a certain date. Scheduling consists of the task and completion time for the various task to be performed. The main purpose of scheduling is to see that all work is completed between the given time. If the works are completed in an allotted time, the timeline of works can be made on time. Meanwhile, the timeline of works not made on time as the works are not completed in the allocated time. Another purpose is to accomplish recurrent tasks on a shorter time than perform the tasks manually. In other words, schedules must optimise the timeline of works and focus on the quality of works.

Scheduling will give many advantages. First, scheduling will help the important projects finished on track. Checking a to-do list each day, at the very least, reminds of upcoming deadlines, prioritize the assigned projects will help to prioritize the most important projects first. Scheduling can improve financial planning for small business owners whose are often struggle with cash flow. Scheduling the credit terms, sales, deliveries and receivables to give owners plenty of time to pay bills. If an organization have a financial reporting schedule in place, them can move money from one account to another, or take out a bridge loan, when necessary to make the payments. Lastly, scheduling makes a better project management. This is because there are companies that rely on projects to manage everything from marketing to production to executive searches. Projects often include multiple phases or teams, and without strict schedules, they can get off track.

2.3 ACADEMIC ASSEMBLY SCHEDULING PROBLEM

Academic procession concerned with assigning two sessions and limited number of gown or hood for each lecturer by satisfying all the constrains. All the constrains are states as follows:

I. Only lecturers from the related faculties during the session will be selected to attend academic assembly.

II. Lecturers must have at least one session gap between the two involved sessions.

III. Lecturer must have a replacement if they are unable to attend the assembly.

2.4 REAL WORLD ACADEMIC ASSEMBLY IN UMP CONVOCATION CEREMONY SCHEDULING DATASET

The datasets that will be used is number of gown or hood and list name of involved lecturers in Academic Procession during 12^{th} UMP Convocation Ceremony.

2.4.1 GOWN OR HOOD DATASET

There are five sizes of gown or hood provided by UMP. This dataset provided by Secretariat of UMP Convocation Ceremony. The total numbers of provided gown or hood is 353. The dataset is shown as in table 2.1.

Table 2.1 Gown or hood Dataset

Size	Number of gown or hood
S	42
M	152
L	40
XL	104
XXL	15
Total	353

This dataset is not included the gown or hood that had be rejected. Logically, the are 53 extras gown or hood.

2.4.2 NAME LIST OF INVOLVED LECTURERS IN ACADEMIC ASSEMBLY DURING 12TH UMP CONVOCATION CEREMONY DATASET

There are ten faculties in UMP. Each faculty provides at least 25 lecturers to attend the academic assembly. This dataset is provided by BPA UMP. The dataset can be shown as in table 2.2.

Table 2.2 12th UMP Convocation Ceremony Dataset

No	Faculty	Number of lecturers
1	Centre for Modern Languages & Human Sciences	25 lecturers
2	Faculty of Chemical & Natural Resources Engineering	31 lecturers
3	Faculty of Civil Engineering & Earth Resources	32 lecturers
4	Faculty of Computer Systems & Software Engineering	32 lecturers
5	Faculty of Electrical & Electronics Engineering	30 lecturers
6	Faculty of Engineering Technology	25 lecturers
7	Faculty of Industrial Management	30 lecturers

8	Faculty of Industrial Sciences and Technology	32 lecturers
9	Faculty of Manufacturing Engineering	31 lecturers
10	Faculty of Mechanical Engineering	32 lecturers

Each session has different number of lecturers involved. This can be shown by Table 2.3:

Table 2.3 Number of lecturers involve in each session

Session	Number of lecturers
1	150 lecturers
2	50 lecturers
3	50 lecturers
4	50 lecturers
5	300 lecturers

The number of lecturer involve in each faculty for each session can be shown by table 2.4.

Table 2.4 Number of lecturer involve in each faculty for each session

Session	Faculty	Number of lecturers
1	Centre for Modern Languages & Human Sciences	15 lecturers
	Faculty of Chemical & Natural Resources Engineering	15 lecturers
	Faculty of Civil Engineering & Earth Resources	15 lecturers
	Faculty of Computer Systems & Software Engineering	15 lecturers
	Faculty of Electrical & Electronics Engineering	15 lecturers
	Faculty of Engineering Technology	15 lecturers
	Faculty of Industrial Management	15 lecturers
	Faculty of Industrial Sciences and Technology	15 lecturers

	Faculty of Manufacturing Engineering	15 lecturers
	Faculty of Mechanical Engineering	15 lecturers
2	Faculty of Industrial Sciences and Technology	17 lecturers
	Faculty of Manufacturing Engineering	16 lecturers
	Faculty of Mechanical Engineering	17 lecturers
3	Faculty of Chemical & Natural Resources Engineering	16 lecturers
	Faculty of Civil Engineering & Earth Resources	17 lecturers
	Faculty of Computer Systems & Software Engineering	17 lecturers
4	Centre for Modern Languages & Human Sciences	10 lecturers
	Faculty of Electrical & Electronics Engineering	15 lecturers
	Faculty of Engineering Technology	10 lecturers
	Faculty of Industrial Management	15 lecturers
5	Centre for Modern Languages & Human Sciences	25 lecturers
	Faculty of Chemical & Natural Resources Engineering	31 lecturers
	Faculty of Civil Engineering & Earth Resources	32 lecturers
	Faculty of Computer Systems & Software Engineering	32 lecturers
	Faculty of Electrical & Electronics Engineering	30 lecturers
	Faculty of Engineering Technology	25 lecturers
	Faculty of Industrial Management	30 lecturers
	Faculty of Industrial Sciences and Technology	32 lecturers
	Faculty of Manufacturing Engineering	31 lecturers
	Faculty of Mechanical Engineering	32 lecturers

The schedule of faculty involved in each session is shown as Table 2.5.

Table 2.5 Faculty that involved in each session

Session	**Faculty involved**
1	Faculty of Mechanical Engineering
	Faculty of Manufacturing Engineering

2	Faculty of Computer Systems & Software Engineering
	Faculty of Chemical & Natural Resources Engineering
3	Faculty of Engineering Technology
	Faculty of Electrical & Electronics Engineering
4	Faculty of Industrial Management
	Faculty of Industrial Sciences and Technology
5	Faculty of Electrical & Electronics Engineering
	Faculty of Chemical & Natural Resources Engineering
	Faculty of Civil Engineering & Earth Resources
	Faculty of Computer Systems & Software Engineering
	Faculty of Mechanical Engineering

2.5 APPROACH FOR THE SCHEDULING PROBLEM

There are two main types of approaches that can be used for scheduling problems which is resource-based scheduling and task-based scheduling. Resource-based scheduling is set of procedure and strategy that being used by an organisation to allocate their resources, their projects that need to accomplish, and schedule start and end dates for each duty or development based on resource availability. The resources included people, equipment, facilities, and machines depending on the industry needs. Example pf resource-based scheduling is Genetic Algorithm. The second approach is task-based scheduling. Task-based scheduling is a selection of resources to activities are considered as temporally blackjack events. The example of task-based scheduling is Hill Climbing algorithm.

2.5.1 HILL CLIMBING ALGORITHM

Hill Climbing is used for mathematical optimization problems in the field of heuristic search. This algorithm is a variant of generate and test algorithm as it takes the feedback from test procedure that will utilize by the generator in deciding the next move in search space. Greedy approach which is the search moves in one direction only which enhances the cost of function any point in state space is used in this algorithm.

There are three type of hill climbing algorithm which are Simple hill climbing, steepest-ascent hill climbing and stochastic hill climbing. Simple hill climbing will examine the neighbouring nodes one by one and selects the first neighbouring node which optimizes the current cost as next node. Steepest-Ascent Hill climbing will examine all the neighbouring nodes first and then selects the node closest to the solution state as next node. Meanwhile the stochastic hill climbing does not overlook all the neighbouring nodes before choosing which node to select. It just selects a neighbouring node by chance and decides whether move to the selected neighbour or to examine another neighbour based on the number of improvement in the preferred neighbour.

The problems of this algorithm are local maximum, plateau and ridge. Local maximum happens when the algorithm stops making advancement towards an optimal solution mainly due to the lack of instantaneous enhancement in adjacent states. As example, all neighbouring states have a value which is worse than the current state at local maximum. Since hill climbing uses greedy approach, it will not move to the worse state and terminate itself. The process will end even though a better solution may exist. Plateau occurs when all neighbours have same value. Hence, it is not possible to select the best direction. Ridge occurs when any point on a ridge can look like peak because movement in all possible directions is downward. Hence the algorithm stops when it reaches this state.

One of the paper that can be an example is University Course Timetabling Problem (UCTP) which are known as one of the hardest problem faced by academic institutions around the world. The UCTP is a difficult combinatorial optimization problem that has been widely studied over the year. The problem involves scheduling a given number of courses to a limited number of periods and rooms subject to satisfying a set of given constraints. The proposed techniques are Hill Climbing and Hybridized-

ABC. This proposed algorithm is coded in Microsoft Visual C++6.0 on Windows 7 platform on Intel 2 GHz Core 2 Quad processor with 2 GB of RAM. The performance of the proposed algorithm is tested using the dataset conventional by Socha et al. The dataset comprises 100–400 courses that are needed to be assigned to a timetable with 45 timeslots corresponding to 5 days of 9 hours each, at the same time satisfying room features and room capacity constraints which are divided into three types. The types are small, medium and large. The Hybridized-ABC algorithm is able to strive a high enhancement at the beginning of the search for the medium and large problem instances, while towards end of runs the proposed method almost festered. This is because the hill climbing optimizer attracted the solutions into the local optima during the search and the most advantage of hill climbing is gained at the initial stage of the search.

2.5.2 SIMULATED ANNEALING ALGORITHM

Simulated annealing is a method for discovering a good finding answer to an optimization problem. The finding not necessarily a perfect solution. In a state where solution needed to maximize or minimize something, it can likely be attach with simulated annealing. The traveling salesman problem can be the example. The salesman is searching to stopover a set of cities in the order that the total number of miles he travels is minimizes. (Selman & P. Gomes) As the number of cities gets big, it becomes too calculation intensive to inspect every possible itinerary. Simulated annealing's advantage is it dodges getting capture at local maximum which are better than any others algorithm, but not the very best. (Selman & P. Gomes)

This algorithm involves 5 basic steps which starting by generate a random solution. The major point is the solution created by random. Second, its cost using some defined cost function calculate depending on your issue. The cost function might be as easy as calculate the total number of miles the traveling salesman's travelled or it might be a difficult combination of multiple factors. Next, make a random neighbouring solution. Neighbouring point to the only one item that make a different between the old solution and the new solution. Then, the two basics of solution being swap and re-calculate the cost effectively. Forth, count the new solution's cost by using the same cost function. Next, comparing the new cost and the old cost. The smaller the cost of the solution, the better the solution. This makes the algorithm getting nearer to an optimum. Lastly, repeat steps 3 to 5 until a suitable solution is produce.

The advantages of Simulated Annealing are good at escape from get caught in local optimum problem and much better on calculate at finding a suitable global optimum.

2.5.3 TABU SEARCH ALGORITHM

Tabu search is a global optimization and a Metaheuristic algorithm for handling an embedded heuristic technique. Parallel Tabu search is an example of Tabu search. Tabu search also known as parent for a large family of derivative approaches that introduce memory structures in Metaheuristics.

To restrain an embedded heuristic from reoccurrence to recently visited areas of the search space is the objective of Tabu search. The strategy of this algorithm is to conserve a short-term memory of the changes of recent moves within the search space and block future moves from ruining those changes.

The aim of designing Tabu search is to control an embedded hill climbing heuristic, although may be adjusted to be able to any neighbourhood exploration heuristic. Tabu search had been useful to distinct domains such as combinatorial optimization problems. Nominee for neighbouring moves can be contributing to determine for the entire neighbourhood or the neighbourhood can be randomly sampled to a fixed size. Intermediate-term memory structures can be exposed to mark the search on soothing areas of the search space named aspiration criteria. Long-term memory structures can be familiarized to inspire meaningful research of the broader search space, called diversification. The tactic of this algorithm may involve determining solutions with rarely used components and biasing the generation away from the most usually used solution components.

Tabu search is used to puzzle out combinatorial optimization problems. Dynamic neighbourhood search method is an example of Tabu search algorithm. The method used is get a random solution. In addition, this algorithm uses of an adaptable memory to narrow the next solution selected to some subset of neighbourhood of current solution.

Tabu Search has three dominant strategies which are forbidding, freeing and short-term strategies. Forbidding strategy will be a controller that control what come in to the tabu list. Freeing strategy will control what come out from the tabu list. Short-term

strategy will be able to interact between the forbidding strategy and freeing strategy to choose trial solutions.

Pros using Tabu search algorithm is its permits non-improving solution to be recognized for free from a local optimum. Hence, number of repetitions by using Tabu search could be very large and this algorithm had too many limitations to be determined.

2.5.4 DISCUSSION AND SUMMARY OF THE APPROACH

There are three techniques that had been proposed to Schedule the Academic Assembly in UMP Convocation. The main objective is to make a reasonable schedule of Academic Assembly for UMP lecturers.

Table 2.6 Summary of the approach

Algorithm	Related Paper	Notable Features	Challenges
Hill Climbing	(Selman & P. Gomes, n.d.)	1. Good exploitation capabilities. 2. No parameter settings.	Trap into local optimum.
Simulated Annealing	(Du & Swamy, 2016)	1. Avoid convergence into local optimum.	Effectiveness highly depends on neighborhood structure of initial solution.
Tabu Search	(Naama, Bouzeboudja & Allali, 2013)	1. Fewer parameter settings.	Effectiveness highly depends on neighborhood structure of initial solution.

2.6 CONCLUSION

The technique that will be used for scheduling Academic Procession in UMP Convocation is Hill Climbing Algorithm. This algorithm good at exploitation capabilities. In addition, this algorithm has no parameter settings. This algorithm obliging in solving optimization problems where the objective is to find the best state according

to the objective of Academic Procession in UMP Graduation that stated in Section 2.3. There are many researchers to use this technique in scheduling, circuit designing, vehicle routing and portfolio management.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter discussed on the methodology that being used in this research. Explanation about software and hardware used in this thesis also discussed in this chapter. The activities for each phase according to the process involves in conduction research was shown in Gantt Chart. The implementation of the data and the algorithm also discussed in this chapter.

3.2 METHODOLOGY

Methodology is a procedure of workflow to complete this research. This methodology will explain briefly how this research had been completed. This methodology also can be predicting any problem that might occurs in this research. In this research, there are seven procedures are being used. All the procedures involve in conduction research can be classifies as Figure 3.1.

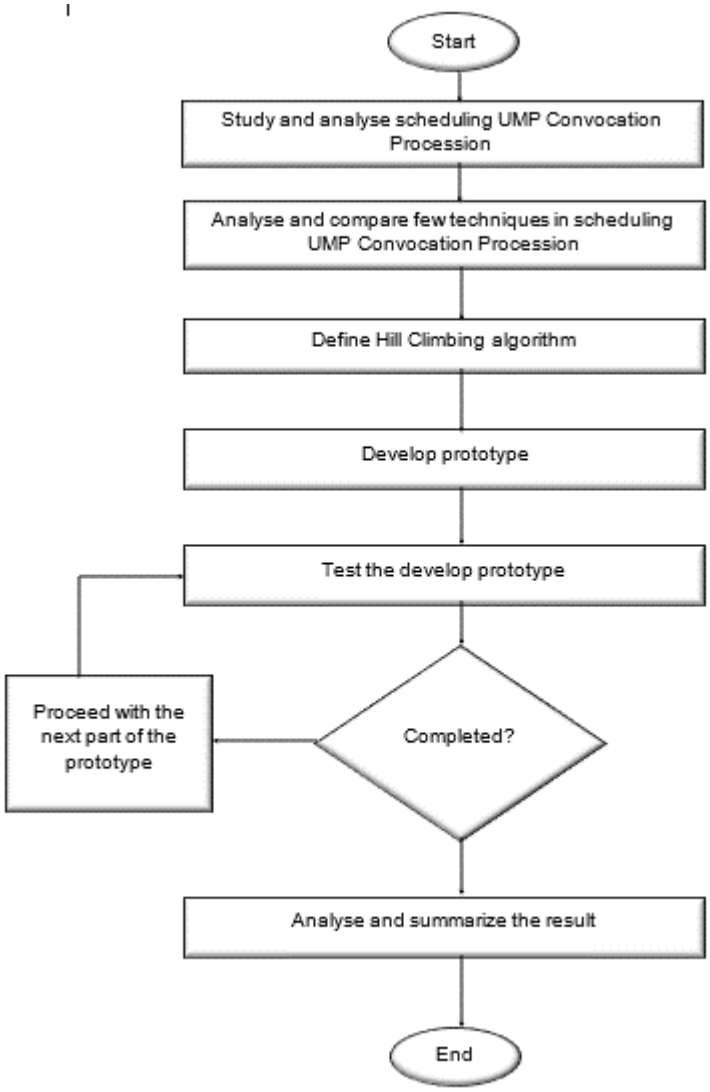

Figure 3.1 Process Involves in Conduction Research

3.2.1 Study and analyse scheduling UMP Convocation Procession

First step is to study and analyse the scheduling UMP Convocation Procession. There are three files being scheduled in this thesis. First file has data of number of lecturers involved in UMP Convocation Ceremony. This file will be provided by each faculty. Second file consists data of each session capacity that provided by BPA and the last file which also provided by BPA has list of faculties involved in each session. In this step, constrains and conditions were determined. The constrains and condition is stated in Chapter One.

3.2.2 Analysed and compared few techniques in scheduling UMP Convocation Procession

Second step is analysed and compared few techniques in scheduling UMP Convocation Procession. There are many techniques that can be used in scheduling. In this thesis, there are three technique that being compared to be used which are Hill Climbing, Simulated Annealing and Tabu Search. The comparison can be seen in the chapter two in this thesis. The advantages and disadvantages of each technique is stated in Chapter Two. Hill Climbing algorithm had been chosen after the analysis.

3.2.3 Define Hill Climbing algorithm

Third step is defining hill climbing algorithm. Algorithm will help to understand how the prototype works. In this thesis, the algorithm for scheduling UMP Convocation Procession will be shown in the Chapter Four. The algorithm also helps to implement the constrains and condition in the prototype.

3.2.4 Develop prototype

The forth step is develop prototype. The hardware and software that being used in doing the prototype is stated in Section 3.3. The algorithm is being implemented in this step. All the constrains and condition also being implement in the algorithm so that the prototype can show how Hill Climbing works in scheduling. In this prototype, Java programming language is used.

3.2.5 Test the develop prototype

The fifth step is testing the develop prototype. When one condition or constraint had being implemented, the prototype will be tested. The test purpose is make sure the constraint or condition had been implemented in the prototype. This step would be implement until the prototype is completed all the constraints and conditions.

3.2.6 Proceed with the next part of the prototype

The next step if the prototype is not completed is proceed with the next part of the prototype. This step will be continuing until all constrains and conditions had been implemented in the prototype and had been tested. The next part of the prototype is be

shown in Figure 4.1 in Section 4.2. All the constraints and conditions will be implemented in the prototype first before proceeding to the last step.

3.2.7 Analyse and summarize the result

The last step if the prototype has been completed is analyse and summarized the result. This step will be shown in Chapter Five. The result from prototype will be summarised and compared with the old schedule. This step will help to make decision if hill climbing is suitable to use in scheduling.

3.3 HARDWARE AND SOFTWARE REQUIREMENT

The only hardware will be used in this thesis is HP Laptop 15-bs0xx. This hardware using Intel® Core™ i5-7200U CPU @ 2.5GHz 2.70 GHz. The installed RAM is 4GB.

Software that will be used is NetBeans IDE 8.2 and MySQL. Since the language used for the prototype is Java, NetBeans IDE 8.2 is used as platform of development. NetBeans is an integrated development environment (IDE) for Java. Microsoft Office Excel is used as data visualisation tools for decision making. Microsoft Excel help to identify easily how many times do the lecturer attend the Academic Procession in Convocation Ceremony 2017. Microsoft Office PowerPoint is used to create presentation slides show and make the presentation more interesting.

3.4 GANTT CHART

The estimated duration for each phase in Process Involves in conduction research which were discussed in 3.2 can be shown in Figure 3.2.

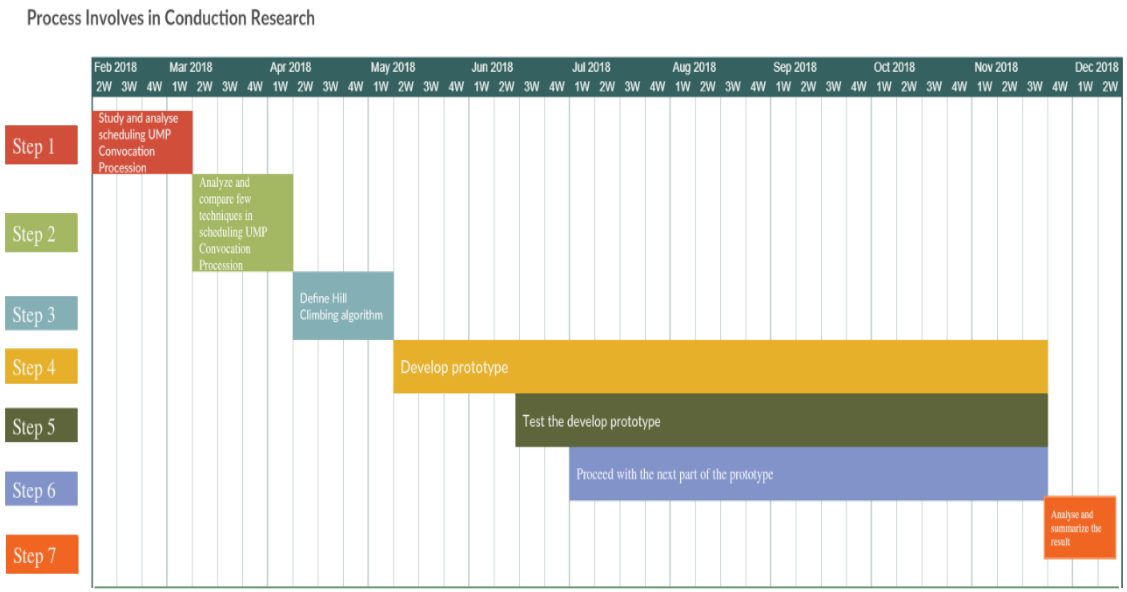

Figure 3.2 Gantt Chart of estimated duration for process conduction Research

3.5 CONCLUSION

This chapter had conversed on the methodology that being used in this research. Description about software and hardware used in this thesis also included in this chapter. The activities for each phase rendering the process involves in transmission research was revealed in Gantt Chart. The implementation of the data and the algorithm also had been conferred in this chapter.

CHAPTER 4

DESIGN AND IMPLEMENTATION

4.1 INTRODUCTION

In this chapter, the design and the process of implementation would be explained. The algorithm is the first to be explained. The process of data gathering also being discuss. The interface of the prototype is also shown in this chapter.

4.2 DEFINE ALGORITHM

The algorithm of the prototype is shown as Figure 4.1. This algorithm had considered the problems that stated in Section 2.3.

```
Step 1: Start.
Step 2: Read all files.
Step 3: Initialize matrix of number of lecturer by number of session.
Step 4: For every column and row of the matrix
        If the lecturer is from faculty that involved in the session,
        If lecturer had involved in the procession less or at least 2,
        If number of lecturer involved in the session is less than the capacity of the session,
                Then, matrix become 1.
        End If.
        End If.
        End If.
        End For.
Step 5: For every column and row of the matrix
        For number of lecturer involved in the session is less than the capacity of the session,
        Pick random position in the matrix.
        If the random position is 0,
        If the lecturer had been involved in the procession less than two times,
                Then, matrix become 1.
        End If.
        End If.
        End For.
        End For.
Step 6: End
```

Figure 4.1 Algorithm of Scheduling UMP Convocation Procession

Figure 4.1 explained how the constrains and conditions were implement. The condition is implemented in step 4 while the constrains is implemented in step 5. The matrix is used to hold the placement by each lecturer in session of UMP Convocation ceremony. The step 2 is where the prototype will read the three files. If the position of matrix meets all the conditions, so the position would be '1' which means, the lecturer will involve in the session.

```
File flec= new File ("C:\\Users\\reenz\\Documents\\SE\\PSM\\Material\\Lecturer.xls");
File fsesi= new File ("C:\\Users\\reenz\\Documents\\SE\\PSM\\Material\\Sesi.xls");
File fcap= new File ("C:\\Users\\reenz\\Documents\\SE\\PSM\\Material\\Kapasiti.xls");
Workbook wblec = Workbook.getWorkbook(flec);
Sheet slec = wblec.getSheet(0);
rowlec=slec.getRows();
collec=slec.getColumns();

Workbook wbsesi = Workbook.getWorkbook(fsesi);
Sheet ssesi = wbsesi.getSheet(0);
rowsesi=ssesi.getRows();
colsesi=ssesi.getColumns();

Workbook wbcap = Workbook.getWorkbook(fcap);
Sheet scap = wbcap.getSheet(0);
rowcap=scap.getRows();
colcap=scap.getColumns();
```

Figure 4.2 Coding for Step 2

Coding for step 2 in the algorithm is shown as Figure 4.2. This code will read three files which are name of lecturers, name of faculty will be involves in each session and number of lecturers will involves in each session.

```
int[][] newposition= new int[rowcap][rowlec];
int[][] finalposition= new int[rowcap][rowlec];
String[][] cap =  new String[rowcap][1];
```

Figure 4.3 Coding for Step 3

Coding for step 3 in the algorithm is shown as Figure 4.3. This coding is to initiate an array that consists of number of session, number of lecturers and position of each lecturer. The position will determine which session will be involved by the lecturer.

```
//compulsory condition
 for( a=0; a<rowlec; a++){
 for( b=0; b<rowcap; b++){
 for(int c=0; c<rowsesi; c++){
lecturer[a]=0;
String sesi = ssesi.getCell(d,c).getContents();
    g=b+1;
    String cap= Integer.toString(g);

      if(slec.getCell(2,a).getContents().equalsIgnoreCase(sesi)){
      if(ssesi.getCell(0,c).getContents().equals(cap)){
         position[b][a]=1;
```

Figure 4.4 Coding for Step 4

Coding for step 4 in the algorithm is shown as Figure 4.4. This coding will select lecturers that match with the constrains which is the lecturer is from faculty that involved in the session and number of lecturer involved in the session is less than the capacity of the session. Since this is an initial position for the matrix, the constrain which is lecturer had involved in the procession less or at least 2.

```
switch(sesi){
    case "CMLHS": cmlhs -=1;
    break;
    case "FTEK": ftek -=1;
    break;
    case "FIM": fim -=1;
    break;
    case "FKASA": fkasa -=1;
    break;
    case "FKEE": fkee -=1;
    break;
    case "FKKSA": fkksa -=1;
    break;
    case "FKM": fkm -=1;
    break;
    case "FKP": fkp -=1;
    break;
    case "FSKKP": fskkp -=1;
    break;
    case "FSTI": fsti -=1;
    break;
    default: break;
}
}
}
}
}
}
```

Figure 4.5 Continuation of Coding for Step 4

```
for( int i=0; i<rowlec; i++){
for( int j=0; j<collec; j++){
 String faklec = slec.getCell(j,i).getContents();

  switch(faklec){
      case "CMLHS": cmlhs +=2;
      break;
      case "FTEK": ftek +=2;
      break;
      case "FIM": fim +=2;
      break;
      case "FKASA": fkasa +=2;
      break;
      case "FKEE": fkee +=2;
      break;
      case "FKKSA": fkksa +=2;
      break;
      case "FKM": fkm +=2;
      break;
      case "FKP": fkp +=2;
      break;
      case "FSKKP": fskkp +=2;
      break;
      case "FSTI": fsti +=2;
      break;
      default: break;
  }
}
 }
```

Figure 4.6 Coding of calculate the total number of lecturers for each faculty

Extension of coding for step 4 in the algorithm is shown as Figure 4.5. This coding used for calculating the total balance of available lecturers from each faculty for being scheduled. The coding of calculate the total number of lecturers for each faculty is shown as Figure 4.6.

```
for(int ff=0;ff<rowcap;ff++){
   for(int e=0;e<rowlec;e++){

        int k=rand.nextInt(rowlec);
        if(newposition[4][e]==0){
          if(lecturer[k]<3){
            switch(faklecturer[e]){
              case "CMLHS":
             newposition[4][e]=1;
            i-=1;
          s+=1;
             cmlhs -=1;
              break;
              case "FTEK":
             newposition[4][e]=1;
             i-=1;
          s+=1;
             ftek -=1;
              break;
              case "FIM":
             newposition[4][e]=1;
             i-=1;
          s+=1;
             fim -=1;
              break;
              case "FKASA":
             newposition[4][e]=1;
            i-=1;
          s+=1;
             fkasa -=1;
              break;
              case "FKEE":
             newposition[4][e]=1;
             i-=1;
          s+=1;
             fkee -=1;
              break;
              case "FKKSA":
             newposition[4][e]=1;
             i-=1;
          s+=1;
             fkksa -=1;
              break;
```

```
            case "FKM":
           newposition[4][e]=1;
           i-=1;
        s+=1;
           fkm -=1;
            break;
            case "FKP":
           newposition[4][e]=1;
          i-=1;
        s+=1;
           fkp -=1;
            break;
            case "FSKKP":
           newposition[4][e]=1;
           i-=1;
        s+=1;
           fskkp -=1;
            break;
            case "FSTI":
           newposition[4][e]=1;
           i-=1;
        s+=1;
           fsti -=1;
            break;
            default: break;
        }
                    }
          }
}
        }
```

Figure 4.7 Coding for Step 5

The coding for step 5 in the algorithm is shown as Figure 4.7. The random position in the matrix will be pick. If the position match with the constrains which are number of lecturer involved in the session is less than the capacity of the session, the random position is 0, and the lecturer had been involved in the procession less than two times, the position of the matrix will become 1.

4.3 DATA GATHERING

The data is provided from BPA has been discussed in Chapter Two. The data that had been gathered are data of gown or hood according to sizes, number of lecturers involve in each session, and number of lecturer involve in each faculty for each session. The data is used to make prototype using Hill Climbing technique.

4.4 THE INTERFACE DESIGN FOR THE PROTOTYPE

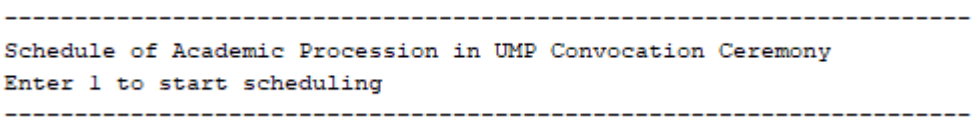

Figure 4.8 Algorithm of Scheduling Academic Procession on UMP Convocation

User enter ‘1’ to start scheduling the academic procession on UMP Convocation. All the constrains and conditions will start to be implemented.

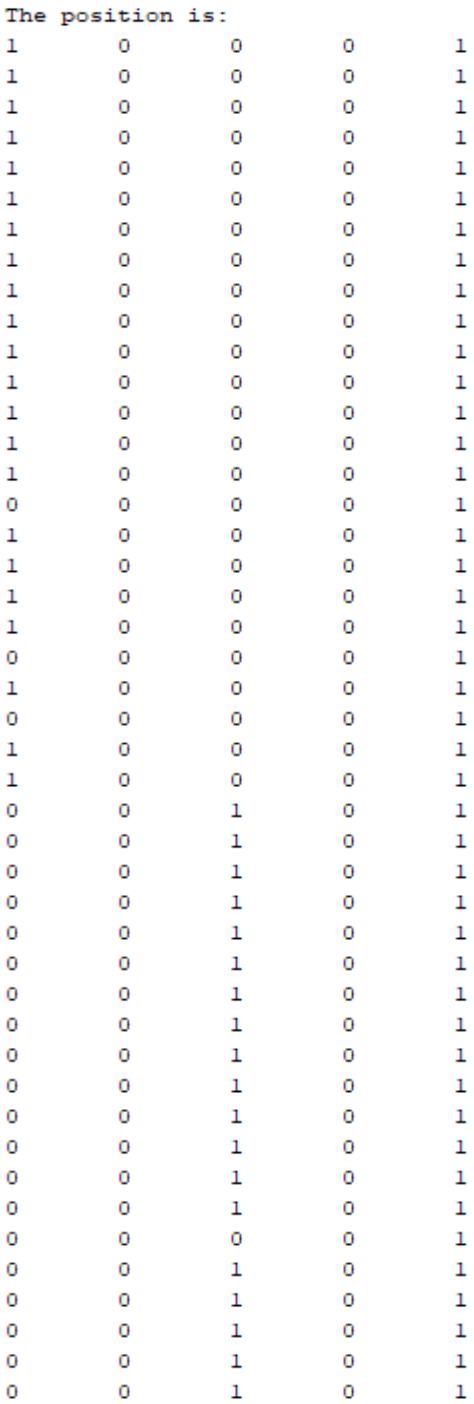

Figure 4.9 When Schedule is Generated

This will happen when the schedule is generated. All the constraints and conditions are being implement. The column represents the number of session. The row represents the number of lecturers that had been sorted into their representatives' faculty.

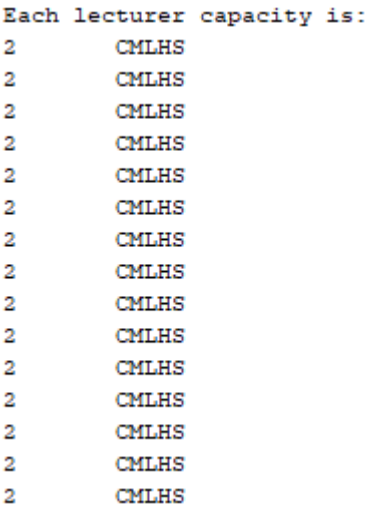

Figure 4.10 The prototype displays each lecturer will involve how many times when the schedule is generated

The purpose of display each lecturer involved is to check either the prototype meets one of the constrains which is each lecturer can involve in the procession maximum for only three times. The minimum is two times.

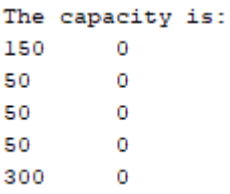

Figure 4.11 The prototype will display the total for every session when schedule is generated

This interface purpose is to check the prototype meet the capacity for each session. If the prototype not meet the capacity, the balance or number of people that the session need will be display next to the number of every session.

CHAPTER 5

RESULT AND DISCUSSION

5.1 INTRODUCTION

All the result from the prototype will be show and discussed in this chapter. The result will be compared to make sure this result is more efficient that the old algorithm. The result also will be discussed either the algorithm is suitable or not for scheduling purpose. Research constraints and future work is also discussed in this chapter.

5.2 RESULT FOR UMP CONVOCATION PROCESSION DATA USING HILL CLIMBING ALGORITHM

The schedule that have been made by the prototype is shown in Table 5.1. The lecturers had been sorted into their representatives' faculty. The schedule is based on the faculty that had been assigned in the session. As example, if the Session One involved faculty of Mechanical and Faculty of Computer Science, then the lecturers from the two faculty will be automatically assigned in the session.

Table 5.1 Schedule made by the prototype

No	Id No of Lecturers	Faculty	Session				
			1	2	3	4	5
1	0133	CMLHS	1	0	0	0	1
2	0152	CMLHS	1	0	0	0	1
3	0156	CMLHS	1	0	0	0	1
4	2406	CMLHS	1	0	0	0	1
5	0276	CMLHS	1	0	0	0	1
6	0278	CMLHS	1	0	0	0	1
7	0083	CMLHS	1	0	0	0	1
8	0197	CMLHS	1	0	0	0	1
9	0602	CMLHS	1	0	0	0	1
10	0644	CMLHS	1	0	0	0	1
11	01461	CMLHS	1	0	0	0	1
12	2291	CMLHS	1	0	0	0	1
13	2375	CMLHS	1	0	0	0	1
14	2177	CMLHS	1	0	0	0	1
15	01403	CMLHS	1	0	0	0	1
16	2355	CMLHS	1	0	0	0	1
17	01373	CMLHS	1	0	0	0	1
18	01159	CMLHS	1	0	0	0	1
19	0687	CMLHS	1	0	0	0	1
20	01126	CMLHS	1	0	0	0	1
21	0209	CMLHS	1	0	0	0	1
22	0214	CMLHS	1	0	0	0	1
23	01187	CMLHS	1	0	0	0	1
24	0436	CMLHS	1	0	0	0	1
25	0684	CMLHS	1	0	0	0	1
26	1768	FTEK	0	0	1	0	1
27	0181	FTEK	0	0	1	0	1

28	2250	FTEK	1	0	0	0	1
29	0794	FTEK	1	0	0	0	1
30	01299	FTEK	1	0	0	0	1
31	2407	FTEK	1	0	0	0	1
32	0081	FTEK	0	0	1	0	1
33	2048	FTEK	0	0	1	0	1
34	01818	FTEK	0	0	1	0	1
35	0657	FTEK	0	0	1	0	1
36	01571	FTEK	1	0	0	0	1
37	01567	FTEK	1	0	0	0	1
38	01744	FTEK	0	0	1	0	1
39	2387	FTEK	0	0	1	0	1
40	2409	FTEK	0	0	1	0	1
41	2319	FTEK	0	0	1	0	1
42	01786	FTEK	0	0	1	0	1
43	2139	FTEK	0	0	1	0	1
44	01543	FTEK	0	0	1	0	1
45	01297	FTEK	0	0	1	0	1
46	01598	FTEK	0	0	1	0	1
47	2187	FTEK	0	0	1	0	1
48	01556	FTEK	0	0	1	0	1
49	01785	FTEK	0	0	1	0	1
50	01625	FTEK	0	0	1	0	1
51	2045	FIM	1	0	0	0	1
52	2382	FIM	0	0	0	1	1
53	01491	FIM	0	0	0	1	1
54	01766	FIM	0	0	0	1	1
55	01577	FIM	0	0	0	1	1
56	01756	FIM	0	0	0	1	1
57	2418	FIM	0	0	0	1	1
58	2383	FIM	1	0	0	0	1
59	01846	FIM	1	0	0	0	1

60	01339	FIM	0	0	0	1	1
61	1846	FIM	1	0	0	0	1
62	01180	FIM	1	0	0	0	1
63	2315	FIM	1	0	0	0	1
64	01662	FIM	0	0	0	1	1
65	2234	FIM	1	0	0	0	1
66	2330	FIM	0	0	0	1	1
67	2272	FIM	0	0	0	1	1
68	0155	FIM	1	0	0	0	1
69	2392	FIM	1	0	0	0	1
70	2316	FIM	1	0	0	0	1
71	01611	FIM	0	0	0	1	1
72	0511	FIM	0	0	0	1	1
73	01368	FIM	0	0	0	1	1
74	0512	FIM	0	0	0	1	1
75	2360	FIM	1	0	0	0	1
76	01608	FIM	0	0	0	1	1
77	0109	FIM	0	0	0	1	1
78	0973	FIM	0	0	0	1	1
79	01659	FIM	0	0	0	1	1
80	2222	FIM	0	0	0	1	1
81	2278	FSTI	0	0	0	1	1
82	2313	FSTI	1	0	0	0	1
83	1389	FSTI	1	0	0	0	1
84	1683	FSTI	0	0	0	1	1
85	0058	FSTI	0	0	0	1	1
86	1870	FSTI	0	0	0	0	1
87	0567	FSTI	0	0	0	0	1
88	1858	FSTI	0	0	0	1	1
89	507	FSTI	1	0	0	0	1
90	1671	FSTI	0	0	0	1	1
91	1620	FSTI	0	0	0	1	1

92	1723	FSTI	0	0	0	1	1
93	0547	FSTI	0	0	0	1	1
94	2056	FSTI	1	0	0	0	1
95	1877	FSTI	0	0	0	1	1
96	1747	FSTI	0	0	0	1	1
97	0281	FSTI	1	0	0	0	1
98	0608	FSTI	0	0	0	1	1
99	1009	FSTI	1	0	0	0	1
100	1869	FSTI	0	0	0	1	1
101	1896	FSTI	0	0	0	1	1
102	1769	FSTI	0	0	0	1	1
103	1767	FSTI	1	0	0	0	1
104	0906	FSTI	0	0	0	1	1
105	1737	FSTI	0	0	0	1	1
106	1544	FSTI	0	0	0	1	1
107	0484	FSTI	0	0	0	1	1
108	0632	FSTI	0	0	0	1	1
109	2416	FSTI	0	0	0	1	1
110	2185	FSTI	0	0	0	1	1
111	1424	FSTI	0	0	0	1	1
112	1031	FSTI	1	0	0	1	1
113	01484	FKP	1	0	0	0	1
114	0215	FKP	1	0	0	0	1
115	2080	FKP	1	0	0	0	1
116	01331	FKP	1	0	0	0	1
117	01324	FKP	1	0	0	0	1
118	01327	FKP	1	0	0	0	1
119	01322	FKP	1	0	0	0	1
120	01854	FKP	1	0	0	0	1
121	01326	FKP	1	0	0	0	1
122	01873	FKP	1	0	0	0	1
123	01560	FKP	1	0	0	0	1

124	2213	FKP	1	0	0	0	1
125	2052	FKP	1	0	0	0	1
126	2196	FKP	1	0	0	0	1
127	0639	FKP	1	0	0	0	1
128	01325	FKP	1	0	0	0	1
129	01328	FKP	1	0	0	0	1
130	01742	FKP	1	0	0	0	1
131	0298	FKP	1	0	0	0	1
132	01330	FKP	1	0	0	0	1
133	01741	FKP	1	0	0	0	1
134	01323	FKP	1	0	0	0	1
135	01576	FKP	1	0	0	0	1
136	0482	FKP	1	0	0	0	1
137	01680	FKP	1	0	0	0	1
138	01772	FKP	1	0	0	0	1
139	01860	FKP	1	0	0	0	1
140	01861	FKP	1	0	0	0	1
141	01329	FKP	1	0	0	0	1
142	01158	FKP	1	0	0	0	1
143	01568	FKP	1	0	0	0	1
144	2349	FSKKP	0	1	0	0	1
145	0043	FSKKP	0	1	0	0	1
146	0120	FSKKP	0	1	0	0	1
147	0010	FSKKP	0	1	0	0	1
148	01862	FSKKP	0	1	0	0	1
149	2273	FSKKP	1	0	0	0	1
150	01469	FSKKP	0	1	0	0	1
151	1986	FSKKP	0	1	0	0	1
152	2148	FSKKP	1	0	0	0	1
153	0080	FSKKP	0	1	0	0	1
154	2178	FSKKP	1	0	0	0	1
155	01840	FSKKP	1	0	0	0	1

156	0060	FSKKP	1	0	0	0	1
157	2149	FSKKP	0	1	0	0	1
158	2123	FSKKP	0	1	0	0	1
159	01494	FSKKP	0	1	0	0	1
160	01805	FSKKP	0	1	0	0	1
161	0153	FSKKP	0	1	0	0	1
162	0159	FSKKP	0	1	0	0	1
163	01842	FSKKP	1	0	0	0	1
164	01511	FSKKP	0	1	0	0	1
165	0044	FSKKP	0	1	0	0	1
166	01866	FSKKP	0	1	0	0	1
167	01679	FSKKP	0	1	0	0	1
168	0053	FSKKP	0	1	0	0	1
169	01863	FSKKP	0	1	0	0	1
170	0027	FSKKP	0	1	0	0	1
171	0063	FSKKP	0	1	0	0	1
172	0052	FSKKP	0	1	0	0	1
173	0064	FSKKP	0	1	0	0	1
174	0121	FSKKP	0	1	0	0	1
175	0132	FSKKP	0	1	0	0	1
176	2346	FKEE	0	0	1	0	1
177	0464	FKEE	0	0	1	0	1
178	0552	FKEE	0	0	1	0	1
179	0347	FKEE	0	0	1	0	1
180	0143	FKEE	0	0	1	0	1
181	0351	FKEE	0	0	1	0	1
182	01752	FKEE	0	0	1	0	1
183	01557	FKEE	0	0	1	0	1
184	0066	FKEE	1	0	0	0	1
185	01851	FKEE	0	0	1	0	1
186	0310	FKEE	0	0	1	0	1
187	01850	FKEE	0	0	1	0	1

188	01811	FKEE	0	0	1	0	1
189	0802	FKEE	0	0	1	0	1
190	0241	FKEE	0	0	1	0	1
191	01853	FKEE	0	0	1	0	1
192	01849	FKEE	0	0	1	0	1
193	01315	FKEE	0	0	1	0	1
194	0801	FKEE	0	0	1	0	1
195	01066	FKEE	1	0	0	0	1
196	0055	FKEE	0	0	1	0	1
197	01052	FKEE	0	0	1	0	1
198	01356	FKEE	0	0	1	0	1
199	01154	FKEE	0	0	1	0	1
200	01156	FKEE	0	0	1	0	1
201	01346	FKEE	0	0	1	0	1
202	0629	FKEE	0	0	1	0	1
203	01317	FKEE	0	0	1	0	1
204	0049	FKEE	0	0	1	0	1
205	0045	FKEE	0	0	1	0	1
206	1373	FKKSA	1	0	0	0	1
207	0749	FKKSA	1	0	0	0	1
208	0336	FKKSA	1	0	0	0	1
209	0313	FKKSA	1	0	0	0	1
210	1648	FKKSA	1	0	0	0	1
211	0126	FKKSA	1	0	0	0	1
212	0805	FKKSA	1	0	0	0	1
213	0441	FKKSA	1	0	0	0	1
214	0439	FKKSA	1	0	0	0	1
215	0360	FKKSA	1	0	0	0	1
216	1747	FKKSA	1	0	0	0	1
217	01022	FKKSA	1	0	0	0	1
218	0819	FKKSA	1	0	0	0	1
219	0456	FKKSA	1	0	0	0	1

220	01285	FKKSA	1	0	0	0	1
221	0322	FKKSA	1	0	0	0	1
222	01111	FKKSA	1	0	0	0	1
223	0076	FKKSA	1	0	0	0	1
224	0179	FKKSA	1	0	0	0	1
225	01646	FKKSA	1	0	0	0	1
226	0118	FKKSA	1	0	0	0	1
227	0586	FKKSA	1	0	0	0	1
228	01392	FKKSA	1	0	0	0	1
229	0542	FKKSA	1	0	0	0	1
230	01352	FKKSA	1	0	0	0	1
231	0450	FKKSA	1	0	0	0	1
232	0532	FKKSA	1	0	0	0	1
233	01411	FKKSA	1	0	0	0	1
234	0538	FKKSA	1	0	0	0	1
235	0174	FKKSA	1	0	0	0	1
236	0696	FKKSA	1	0	0	0	1
237	0341	FKASA	0	1	0	0	1
238	0283	FKASA	0	1	0	0	1
239	01569	FKASA	0	1	0	0	1
240	0092	FKASA	0	1	0	0	1
241	0075	FKASA	1	0	0	0	1
242	2286	FKASA	0	1	0	0	1
243	01474	FKASA	0	1	0	0	1
244	2246	FKASA	1	0	0	0	1
245	01836	FKASA	0	1	0	0	1
246	01676	FKASA	0	1	0	0	1
247	1674	FKASA	0	1	0	0	1
248	01808	FKASA	0	1	0	0	1
249	01562	FKASA	1	0	0	0	1
250	01804	FKASA	0	1	0	0	1
251	01617	FKASA	0	1	0	0	1

252	0682	FKASA	0	1	0	0	1
253	01500	FKASA	0	1	0	0	1
254	0659	FKASA	0	1	0	0	1
255	0689	FKASA	1	0	0	0	1
256	0169	FKASA	1	0	0	0	1
257	0662	FKASA	0	1	0	0	1
258	0736	FKASA	0	1	0	0	1
259	0693	FKASA	1	0	0	0	1
260	0515	FKASA	0	1	0	0	1
261	0685	FKASA	0	1	0	0	1
262	0342	FKASA	1	0	0	0	1
263	0371	FKASA	0	1	0	0	1
264	0435	FKASA	0	1	0	0	1
265	0279	FKASA	0	1	0	0	1
266	0162	FKASA	0	1	0	0	1
267	285	FKASA	1	0	0	0	1
268	1232	FKASA	0	1	0	0	1
269	0306	FKM	1	0	0	0	1
270	0607	FKM	1	0	0	0	1
271	0663	FKM	1	0	0	0	1
272	0666	FKM	1	0	0	0	1
273	01583	FKM	1	0	0	0	1
274	01610	FKM	1	0	0	0	1
275	1966	FKM	1	0	0	0	1
276	0652	FKM	1	0	0	0	1
277	2093	FKM	1	0	0	0	1
278	1486	FKM	1	0	0	0	1
279	1984	FKM	1	0	0	0	1
280	0213	FKM	1	0	0	0	1
281	0612	FKM	1	0	0	0	1
282	0817	FKM	1	0	0	0	1
283	0992	FKM	1	0	0	0	1

284	0624	FKM	1	0	0	0	1
285	01681	FKM	1	0	0	0	1
286	01774	FKM	1	0	0	0	1
287	01778	FKM	1	0	0	0	1
288	0292	FKM	1	0	0	0	1
289	0367	FKM	1	0	0	0	1
290	2078	FKM	1	0	0	0	1
291	01565	FKM	1	0	0	0	1
292	0529	FKM	1	0	0	0	1
293	1895	FKM	1	0	0	0	1
294	0282	FKM	1	0	0	0	1
295	0137	FKM	1	0	0	0	1
296	0630	FKM	1	0	0	0	1
297	0305	FKM	1	0	0	0	1
298	0575	FKM	1	0	0	0	1
299	0738	FKM	1	0	0	0	1
300	1038	FKM	1	0	0	0	1

5.3 COMPARISON RESULT USING A MANUAL ALGORITHM AND HILL CLIMBING ALGORITHM

The schedule that the prototype is generate had been shown in Table 5.1 in Section 5.2. The schedule that had been make using a manual algorithm as shown in Table 5.2.

Table 5.2 The Old Schedule

No	Id No of Lecturers	Faculty	Session				
			1	2	3	4	5
1	0133	CMLHS	1	0	0	0	1
2	0152	CMLHS	1	0	0	0	1
3	0156	CMLHS	1	0	0	0	1
4	2406	CMLHS	0	0	0	1	1
5	0276	CMLHS	1	0	0	0	1
6	0278	CMLHS	1	0	0	0	1
7	0083	CMLHS	1	0	0	0	1
8	0197	CMLHS	1	0	0	0	1
9	0602	CMLHS	1	0	0	0	1
10	0644	CMLHS	1	0	0	0	1
11	01461	CMLHS	1	0	0	0	1
12	2291	CMLHS	0	0	0	1	1
13	2375	CMLHS	0	0	0	1	1
14	2177	CMLHS	0	0	0	1	1
15	01403	CMLHS	0	0	0	1	1
16	2355	CMLHS	0	0	0	1	1
17	01373	CMLHS	0	0	0	1	1
18	01159	CMLHS	0	0	0	1	1
19	0687	CMLHS	0	0	0	1	1
20	01126	CMLHS	0	0	0	1	1
21	0209	CMLHS	1	0	0	0	1
22	0214	CMLHS	1	0	0	0	1
23	01187	CMLHS	1	0	0	0	1
24	0436	CMLHS	1	0	0	0	1
25	0684	CMLHS	1	0	0	0	1
26	1768	FTEK	0	0	0	1	1
27	0181	FTEK	0	0	0	1	1

28	2250	FTEK	1	0	0	0	1
29	0794	FTEK	0	0	0	1	1
30	01299	FTEK	1	0	0	0	1
31	2407	FTEK	1	0	0	0	1
32	0081	FTEK	0	0	0	1	1
33	2048	FTEK	0	0	0	1	1
34	01818	FTEK	1	0	0	0	1
35	0657	FTEK	1	0	0	0	1
36	01571	FTEK	1	0	0	0	1
37	01567	FTEK	1	0	0	0	1
38	01744	FTEK	0	0	0	1	1
39	2387	FTEK	1	0	0	0	1
40	2409	FTEK	1	0	0	0	1
41	2319	FTEK	0	0	0	1	1
42	01786	FTEK	1	0	0	0	1
43	2139	FTEK	0	0	0	1	1
44	01543	FTEK	1	0	0	0	1
45	01297	FTEK	1	0	0	0	1
46	01598	FTEK	1	0	0	0	1
47	2187	FTEK	1	0	0	0	1
48	01556	FTEK	0	0	0	1	1
49	01785	FTEK	1	0	0	0	1
50	01625	FTEK	0	0	0	1	1
51	2045	FIM	1	0	0	0	1
52	2382	FIM	0	0	0	1	1
53	01491	FIM	1	0	0	0	1
54	01766	FIM	1	0	0	0	1
55	01577	FIM	1	0	0	0	1
56	01756	FIM	1	0	0	0	1
57	2418	FIM	1	0	0	0	1
58	2383	FIM	0	0	0	1	1
59	01846	FIM	1	0	0	0	1

60	01339	FIM	1	0	0	0	1
61	1846	FIM	1	0	0	0	1
62	01180	FIM	0	0	0	1	1
63	2315	FIM	0	0	0	1	1
64	01662	FIM	1	0	0	0	1
65	2234	FIM	1	0	0	0	1
66	2330	FIM	1	0	0	0	1
67	2272	FIM	1	0	0	0	1
68	0155	FIM	0	0	0	1	1
69	2392	FIM	0	0	0	1	1
70	2316	FIM	0	0	0	1	1
71	01611	FIM	0	0	0	1	1
72	0511	FIM	0	0	0	1	1
73	01368	FIM	0	0	0	1	1
74	0512	FIM	0	0	0	1	1
75	2360	FIM	1	0	0	0	1
76	01608	FIM	0	0	0	1	1
77	0109	FIM	0	0	0	1	1
78	0973	FIM	1	0	0	0	1
79	01659	FIM	0	0	0	1	1
80	2222	FIM	0	0	0	1	1
81	2278	FSTI	0	1	0	0	1
82	2313	FSTI	1	0	0	0	1
83	1389	FSTI	1	0	0	0	1
84	1683	FSTI	1	0	0	0	1
85	0058	FSTI	1	0	0	0	1
86	1870	FSTI	0	1	0	0	1
87	0567	FSTI	1	0	0	0	1
88	1858	FSTI	1	0	0	0	1
89	507	FSTI	0	1	0	0	1
90	1671	FSTI	0	1	0	0	1
91	1620	FSTI	0	1	0	0	1

92	1723	FSTI	0	1	0	0	1
93	0547	FSTI	0	1	0	0	1
94	2056	FSTI	0	1	0	0	1
95	1877	FSTI	1	0	0	0	1
96	1747	FSTI	1	0	0	0	1
97	0281	FSTI	1	0	0	0	1
98	0608	FSTI	1	0	0	0	1
99	1009	FSTI	0	1	0	0	1
100	1869	FSTI	0	1	0	0	1
101	1896	FSTI	0	1	0	0	1
102	1769	FSTI	0	1	0	0	1
103	1767	FSTI	0	1	0	0	1
104	0906	FSTI	0	1	0	0	1
105	1737	FSTI	0	1	0	0	1
106	1544	FSTI	0	1	0	0	1
107	0484	FSTI	0	1	0	0	1
108	0632	FSTI	1	0	0	0	1
109	2416	FSTI	1	0	0	0	1
110	2185	FSTI	1	0	0	0	1
111	1424	FSTI	1	0	0	0	1
112	1031	FSTI	1	0	0	0	1
113	01484	FKP	1	0	0	0	1
114	0215	FKP	1	0	0	0	1
115	2080	FKP	1	0	0	0	1
116	01331	FKP	0	1	0	0	1
117	01324	FKP	0	1	0	0	1
118	01327	FKP	0	1	0	0	1
119	01322	FKP	0	1	0	0	1
120	01854	FKP	0	1	0	0	1
121	01326	FKP	0	1	0	0	1
122	01873	FKP	0	1	0	0	1
123	01560	FKP	1	0	0	0	1

124	2213	FKP	1	0	0	0	1
125	2052	FKP	1	0	0	0	1
126	2196	FKP	1	0	0	0	1
127	0639	FKP	1	0	0	0	1
128	01325	FKP	0	1	0	0	1
129	01328	FKP	0	1	0	0	1
130	01742	FKP	0	1	0	0	1
131	0298	FKP	0	1	0	0	1
132	01330	FKP	0	1	0	0	1
133	01741	FKP	0	1	0	0	1
134	01323	FKP	0	1	0	0	1
135	01576	FKP	1	0	0	0	1
136	0482	FKP	1	0	0	0	1
137	01680	FKP	1	0	0	0	1
138	01772	FKP	0	1	0	0	1
139	01860	FKP	1	0	0	0	1
140	01861	FKP	1	0	0	0	1
141	01329	FKP	0	1	0	0	1
142	01158	FKP	1	0	0	0	1
143	01568	FKP	1	0	0	0	1
144	2349	FSKKP	1	0	0	0	1
145	0043	FSKKP	0	0	1	0	1
146	0120	FSKKP	1	0	0	0	1
147	0010	FSKKP	0	0	1	0	1
148	01862	FSKKP	1	0	0	0	1
149	2273	FSKKP	1	0	0	0	1
150	01469	FSKKP	0	0	1	0	1
151	1986	FSKKP	1	0	0	0	1
152	2148	FSKKP	1	0	0	0	1
153	0080	FSKKP	0	0	1	0	1
154	2178	FSKKP	1	0	0	0	1
155	01840	FSKKP	1	0	0	0	1

156	0060	FSKKP	0	0	1	0	1
157	2149	FSKKP	1	0	0	0	1
158	2123	FSKKP	1	0	0	0	1
159	01494	FSKKP	0	0	1	0	1
160	01805	FSKKP	1	0	0	0	1
161	0153	FSKKP	0	0	1	0	1
162	0159	FSKKP	0	0	1	0	1
163	01842	FSKKP	1	0	0	0	1
164	01511	FSKKP	0	0	1	0	1
165	0044	FSKKP	0	0	1	0	1
166	01866	FSKKP	1	0	0	0	1
167	01679	FSKKP	1	0	0	0	1
168	0053	FSKKP	0	0	1	0	1
169	01863	FSKKP	1	0	0	0	1
170	0027	FSKKP	0	0	1	0	1
171	0063	FSKKP	0	0	1	0	1
172	0052	FSKKP	0	0	1	0	1
173	0064	FSKKP	0	0	1	0	1
174	0121	FSKKP	0	0	1	0	1
175	0132	FSKKP	0	0	1	0	1
176	2346	FKEE	1	0	0	0	1
177	0464	FKEE	1	0	0	0	1
178	0552	FKEE	0	0	0	1	1
179	0347	FKEE	1	0	0	0	1
180	0143	FKEE	1	0	0	0	1
181	0351	FKEE	1	0	0	0	1
182	01752	FKEE	1	0	0	0	1
183	01557	FKEE	0	0	0	1	1
184	0066	FKEE	0	0	0	1	1
185	01851	FKEE	0	0	0	1	1
186	0310	FKEE	0	0	0	1	1
187	01850	FKEE	0	0	0	1	1

188	01811	FKEE	0	0	0	1	1
189	0802	FKEE	1	0	0	0	1
190	0241	FKEE	1	0	0	0	1
191	01853	FKEE	0	0	0	1	1
192	01849	FKEE	0	0	0	1	1
193	01315	FKEE	1	0	0	0	1
194	0801	FKEE	1	0	0	0	1
195	01066	FKEE	1	0	0	0	1
196	0055	FKEE	1	0	0	0	1
197	01052	FKEE	0	0	0	1	1
198	01356	FKEE	0	0	0	1	1
199	01154	FKEE	0	0	0	1	1
200	01156	FKEE	0	0	0	1	1
201	01346	FKEE	0	0	0	1	1
202	0629	FKEE	1	0	0	0	1
203	01317	FKEE	0	0	0	1	1
204	0049	FKEE	0	0	0	1	1
205	0045	FKEE	1	0	0	0	1
206	1373	FKKSA	1	0	0	0	1
207	0749	FKKSA	0	0	1	0	1
208	0336	FKKSA	0	0	1	0	1
209	0313	FKKSA	1	0	0	0	1
210	1648	FKKSA	1	0	0	0	1
211	0126	FKKSA	1	0	0	0	1
212	0805	FKKSA	1	0	0	0	1
213	0441	FKKSA	1	0	0	0	1
214	0439	FKKSA	0	0	1	0	1
215	0360	FKKSA	1	0	0	0	1
216	1747	FKKSA	0	0	1	0	1
217	01022	FKKSA	0	0	1	0	1
218	0819	FKKSA	0	0	1	0	1
219	0456	FKKSA	0	0	1	0	1

220	01285	FKKSA	1	0	0	0	1
221	0322	FKKSA	1	0	0	0	1
222	01111	FKKSA	0	0	1	0	1
223	0076	FKKSA	0	0	1	0	1
224	0179	FKKSA	1	0	0	0	1
225	01646	FKKSA	0	0	1	0	1
226	0118	FKKSA	1	0	0	0	1
227	0586	FKKSA	0	0	1	0	1
228	01392	FKKSA	0	0	1	0	1
229	0542	FKKSA	0	0	1	0	1
230	01352	FKKSA	0	0	1	0	1
231	0450	FKKSA	1	0	0	0	1
232	0532	FKKSA	1	0	0	0	1
233	01411	FKKSA	0	0	1	0	1
234	0538	FKKSA	1	0	0	0	1
235	0174	FKKSA	1	0	0	0	1
236	0696	FKKSA	0	0	1	0	1
237	0341	FKASA	1	0	0	0	1
238	0283	FKASA	1	0	0	0	1
239	01569	FKASA	1	0	0	0	1
240	0092	FKASA	1	0	0	0	1
241	0075	FKASA	1	0	0	0	1
242	2286	FKASA	0	0	1	0	1
243	01474	FKASA	0	0	1	0	1
244	2246	FKASA	1	0	0	0	1
245	01836	FKASA	0	0	1	0	1
246	01676	FKASA	0	0	1	0	1
247	1674	FKASA	1	0	0	0	1
248	01808	FKASA	0	0	1	0	1
249	01562	FKASA	1	0	0	0	1
250	01804	FKASA	0	0	1	0	1
251	01617	FKASA	0	0	1	0	1

252	0682	FKASA	0	0	1	0	1
253	01500	FKASA	1	0	0	0	1
254	0659	FKASA	0	0	1	0	1
255	0689	FKASA	0	0	1	0	1
256	0169	FKASA	0	0	1	0	1
257	0662	FKASA	0	0	1	0	1
258	0736	FKASA	1	0	0	0	1
259	0693	FKASA	1	0	0	0	1
260	0515	FKASA	0	0	1	0	1
261	0685	FKASA	0	0	1	0	1
262	0342	FKASA	1	0	0	0	1
263	0371	FKASA	1	0	0	0	1
264	0435	FKASA	0	0	1	0	1
265	0279	FKASA	0	0	1	0	1
266	0162	FKASA	0	0	1	0	1
267	285	FKASA	1	0	0	0	1
268	1232	FKASA	1	0	0	0	1
269	0306	FKM	1	0	0	0	1
270	0607	FKM	1	0	0	0	1
271	0663	FKM	0	1	0	0	1
272	0666	FKM	0	1	0	0	1
273	01583	FKM	0	1	0	0	1
274	01610	FKM	0	1	0	0	1
275	1966	FKM	0	1	0	0	1
276	0652	FKM	0	1	0	0	1
277	2093	FKM	1	0	0	0	1
278	1486	FKM	1	0	0	0	1
279	1984	FKM	0	1	0	0	1
280	0213	FKM	0	1	0	0	1
281	0612	FKM	0	1	0	0	1
282	0817	FKM	1	0	0	0	1
283	0992	FKM	0	1	0	0	1

284	0624	FKM	0	1	0	0	1
285	01681	FKM	0	1	0	0	1
286	01774	FKM	0	1	0	0	1
287	01778	FKM	0	1	0	0	1
288	0292	FKM	0	1	0	0	1
289	0367	FKM	0	1	0	0	1
290	2078	FKM	1	0	0	0	1
291	01565	FKM	1	0	0	0	1
292	0529	FKM	1	0	0	0	1
293	1895	FKM	1	0	0	0	1
294	0282	FKM	1	0	0	0	1
295	0137	FKM	1	0	0	0	1
296	0630	FKM	1	0	0	0	1
297	0305	FKM	1	0	0	0	1
298	0575	FKM	0	1	0	0	1
299	0738	FKM	1	0	0	0	1
300	1038	FKM	1	0	0	0	1

The comparison of the two schedules is the new schedule will automatically assign the lecturers from the faculty involved in the session. The old schedule does not assign the lecturers based on the faculty involved. The old schedule will randomly assign lecturers to the session.

Table 5.3 Comparison of old schedule and new schedule

No	Id No of Lecturers	Faculty	New Schedule		Old Schedule	
			Session involved	Total session involved	Session involved	Total session involved
1	0133	CMLHS	1 and 5	2	1 and 5	2
2	0152	CMLHS	1 and 5	2	1 and 5	2
3	0156	CMLHS	1 and 5	2	1 and 5	2
4	2406	CMLHS	1 and 5	2	4 and 5	2
5	0276	CMLHS	1 and 5	2	1 and 5	2
6	0278	CMLHS	1 and 5	2	1 and 5	2
7	0083	CMLHS	1 and 5	2	1 and 5	2
8	0197	CMLHS	1 and 5	2	1 and 5	2
9	0602	CMLHS	1 and 5	2	1 and 5	2
10	0644	CMLHS	1 and 5	2	1 and 5	2
11	01461	CMLHS	1 and 5	2	1 and 5	2
12	2291	CMLHS	1 and 5	2	4 and 5	2
13	2375	CMLHS	1 and 5	2	4 and 5	2
14	2177	CMLHS	1 and 5	2	4 and 5	2
15	01403	CMLHS	1 and 5	2	4 and 5	2
16	2355	CMLHS	1 and 5	2	4 and 5	2
17	01373	CMLHS	1 and 5	2	4 and 5	2
18	01159	CMLHS	1 and 5	2	4 and 5	2
19	0687	CMLHS	1 and 5	2	4 and 5	2
20	01126	CMLHS	1 and 5	2	4 and 5	2
21	0209	CMLHS	1 and 5	2	1 and 5	2
22	0214	CMLHS	1 and 5	2	1 and 5	2
23	01187	CMLHS	1 and 5	2	1 and 5	2
24	0436	CMLHS	1 and 5	2	1 and 5	2
25	0684	CMLHS	1 and 5	2	1 and 5	2
26	1768	FTEK	3 and 5	2	4 and 5	2

27	0181	FTEK	3 and 5	2	4 and 5	2
28	2250	FTEK	1 and 5	2	1 and 5	2
29	0794	FTEK	1 and 5	2	4 and 5	2
30	01299	FTEK	1 and 5	2	1 and 5	2
31	2407	FTEK	1 and 5	2	1 and 5	2
32	0081	FTEK	3 and 5	2	4 and 5	2
33	2048	FTEK	3 and 5	2	4 and 5	2
34	01818	FTEK	3 and 5	2	1 and 5	2
35	0657	FTEK	3 and 5	2	1 and 5	2
36	01571	FTEK	1 and 5	2	1 and 5	2
37	01567	FTEK	1 and 5	2	1 and 5	2
38	01744	FTEK	3 and 5	2	4 and 5	2
39	2387	FTEK	3 and 5	2	1 and 5	2
40	2409	FTEK	3 and 5	2	1 and 5	2
41	2319	FTEK	3 and 5	2	4 and 5	2
42	01786	FTEK	3 and 5	2	1 and 5	2
43	2139	FTEK	3 and 5	2	4 and 5	2
44	01543	FTEK	3 and 5	2	1 and 5	2
45	01297	FTEK	3 and 5	2	1 and 5	2
46	01598	FTEK	3 and 5	2	1 and 5	2
47	2187	FTEK	3 and 5	2	1 and 5	2
48	01556	FTEK	3 and 5	2	4 and 5	2
49	01785	FTEK	3 and 5	2	1 and 5	2
50	01625	FTEK	3 and 5	2	4 and 5	2
51	2045	FIM	1 and 5	2	1 and 5	2
52	2382	FIM	4 and 5	2	4 and 5	2
53	01491	FIM	4 and 5	2	1 and 5	2
54	01766	FIM	4 and 5	2	1 and 5	2
55	01577	FIM	4 and 5	2	1 and 5	2
56	01756	FIM	4 and 5	2	1 and 5	2
57	2418	FIM	4 and 5	2	1 and 5	2
58	2383	FIM	1 and 5	2	4 and 5	2

59	01846	FIM	1 and 4	2	1 and 5	2
60	01339	FIM	4 and 5	2	1 and 5	2
61	1846	FIM	1 and 5	2	1 and 5	2
62	01180	FIM	1 and 5	2	4 and 5	2
63	2315	FIM	1 and 5	2	4 and 5	2
64	01662	FIM	4 and 5	2	1 and 5	2
65	2234	FIM	1 and 5	2	1 and 5	2
66	2330	FIM	4 and 5	2	1 and 5	2
67	2272	FIM	4 and 5	2	1 and 5	2
68	0155	FIM	1 and 5	2	4 and 5	2
69	2392	FIM	1 and 5	2	4 and 5	2
70	2316	FIM	1 and 5	2	4 and 5	2
71	01611	FIM	4 and 5	2	4 and 5	2
72	0511	FIM	4 and 5	2	4 and 5	2
73	01368	FIM	4 and 5	2	4 and 5	2
74	0512	FIM	4 and 5	2	4 and 5	2
75	2360	FIM	1 and 5	2	1 and 5	2
76	01608	FIM	4 and 5	2	4 and 5	2
77	0109	FIM	4 and 5	2	4 and 5	2
78	0973	FIM	4 and 5	2	1 and 5	2
79	01659	FIM	4 and 5	2	4 and 5	2
80	2222	FIM	4 and 5	2	4 and 5	2
81	2278	FSTI	4 and 5	2	2 and 5	2
82	2313	FSTI	1 and 5	2	1 and 5	2
83	1389	FSTI	1 and 5	2	1 and 5	2
84	1683	FSTI	4 and 5	2	1 and 5	2
85	0058	FSTI	4 and 5	2	1 and 5	2
86	1870	FSTI	4 and 5	2	2 and 5	2
87	0567	FSTI	4 and 5	2	1 and 5	2
88	1858	FSTI	4 and 5	2	1 and 5	2
89	507	FSTI	1 and 5	2	2 and 5	2
90	1671	FSTI	4 and 5	2	2 and 5	2

91	1620	FSTI	4 and 5	2	2 and 5	2
92	1723	FSTI	4 and 5	2	2 and 5	2
93	0547	FSTI	4 and 5	2	2 and 5	2
94	2056	FSTI	1 and 5	2	2 and 5	2
95	1877	FSTI	4 and 5	2	1 and 5	2
96	1747	FSTI	4 and 5	2	1 and 5	2
97	0281	FSTI	1 and 5	2	1 and 5	2
98	0608	FSTI	4 and 5	2	1 and 5	2
99	1009	FSTI	1 and 5	2	2 and 5	2
100	1869	FSTI	4 and 5	2	2 and 5	2
101	1896	FSTI	4 and 5	2	2 and 5	2
102	1769	FSTI	4 and 5	2	2 and 5	2
103	1767	FSTI	1 and 5	2	2 and 5	2
104	0906	FSTI	4 and 5	2	2 and 5	2
105	1737	FSTI	4 and 5	2	2 and 5	2
106	1544	FSTI	4 and 5	2	2 and 5	2
107	0484	FSTI	4 and 5	2	2 and 5	2
108	0632	FSTI	4 and 5	2	1 and 5	2
109	2416	FSTI	4 and 5	2	1 and 5	2
110	2185	FSTI	4 and 5	2	1 and 5	2
111	1424	FSTI	4 and 5	2	1 and 5	2
112	1031	FSTI	1,4 and 5	3	1 and 5	2
113	01484	FKP	1 and 5	2	1 and 5	2
114	0215	FKP	1 and 5	2	1 and 5	2
115	2080	FKP	1 and 5	2	1 and 5	2
116	01331	FKP	1 and 5	2	2 and 5	2
117	01324	FKP	1 and 5	2	2 and 5	2
118	01327	FKP	1 and 5	2	2 and 5	2
119	01322	FKP	1 and 5	2	2 and 5	2
120	01854	FKP	1 and 5	2	2 and 5	2
121	01326	FKP	1 and 5	2	2 and 5	2
122	01873	FKP	1 and 5	2	2 and 5	2

123	01560	FKP	1 and 5	2	1 and 5	2
124	2213	FKP	1 and 5	2	1 and 5	2
125	2052	FKP	1 and 5	2	1 and 5	2
126	2196	FKP	1 and 5	2	1 and 5	2
127	0639	FKP	1 and 5	2	1 and 5	2
128	01325	FKP	1 and 5	2	2 and 5	2
129	01328	FKP	1 and 5	2	2 and 5	2
130	01742	FKP	1 and 5	2	2 and 5	2
131	0298	FKP	1 and 5	2	2 and 5	2
132	01330	FKP	1 and 5	2	2 and 5	2
133	01741	FKP	1 and 5	2	2 and 5	2
134	01323	FKP	1 and 5	2	2 and 5	2
135	01576	FKP	1 and 5	2	1 and 5	2
136	0482	FKP	1 and 5	2	1 and 5	2
137	01680	FKP	1 and 5	2	1 and 5	2
138	01772	FKP	1 and 5	2	2 and 5	2
139	01860	FKP	1 and 5	2	1 and 5	2
140	01861	FKP	1 and 5	2	1 and 5	2
141	01329	FKP	1 and 5	2	2 and 5	2
142	01158	FKP	1 and 5	2	1 and 5	2
143	01568	FKP	1 and 5	2	1 and 5	2
144	2349	FSKKP	2 and 5	2	1 and 5	2
145	0043	FSKKP	2 and 5	2	3 and 5	2
146	0120	FSKKP	2 and 5	2	1 and 5	2
147	0010	FSKKP	2 and 5	2	3 and 5	2
148	01862	FSKKP	2 and 5	2	1 and 5	2
149	2273	FSKKP	1 and 5	2	1 and 5	2
150	01469	FSKKP	2 and 5	2	3 and 5	2
151	1986	FSKKP	2 and 5	2	1 and 5	2
152	2148	FSKKP	1 and 5	2	1 and 5	2
153	0080	FSKKP	2 and 5	2	3 and 5	2
154	2178	FSKKP	1 and 5	2	1 and 5	2

155	01840	FSKKP	1 and 5	2	1 and 5	2
156	0060	FSKKP	1 and 5	2	3 and 5	2
157	2149	FSKKP	2 and 5	2	1 and 5	2
158	2123	FSKKP	2 and 5	2	1 and 5	2
159	01494	FSKKP	2 and 5	2	3 and 5	2
160	01805	FSKKP	2 and 5	2	1 and 5	2
161	0153	FSKKP	2 and 5	2	3 and 5	2
162	0159	FSKKP	2 and 5	2	3 and 5	2
163	01842	FSKKP	1 and 5	2	1 and 5	2
164	01511	FSKKP	2 and 5	2	3 and 5	2
165	0044	FSKKP	2 and 5	2	3 and 5	2
166	01866	FSKKP	2 and 5	2	1 and 5	2
167	01679	FSKKP	2 and 5	2	1 and 5	2
168	0053	FSKKP	2 and 5	2	3 and 5	2
169	01863	FSKKP	2 and 5	2	1 and 5	2
170	0027	FSKKP	2 and 5	2	3 and 5	2
171	0063	FSKKP	2 and 5	2	3 and 5	2
172	0052	FSKKP	2 and 5	2	3 and 5	2
173	0064	FSKKP	2 and 5	2	3 and 5	2
174	0121	FSKKP	2 and 5	2	3 and 5	2
175	0132	FSKKP	2 and 5	2	3 and 5	2
176	2346	FKEE	3 and 5	2	1 and 5	2
177	0464	FKEE	3 and 5	2	1 and 5	2
178	0552	FKEE	3 and 5	2	4 and 5	2
179	0347	FKEE	3 and 5	2	1 and 5	2
180	0143	FKEE	3 and 5	2	1 and 5	2
181	0351	FKEE	3 and 5	2	1 and 5	2
182	01752	FKEE	3 and 5	2	1 and 5	2
183	01557	FKEE	3 and 5	2	4 and 5	2
184	0066	FKEE	1 and 5	2	4 and 5	2
185	01851	FKEE	3 and 5	2	4 and 5	2
186	0310	FKEE	3 and 5	2	4 and 5	2

187	01850	FKEE	3 and 5	2	4 and 5	2
188	01811	FKEE	3 and 5	2	4 and 5	2
189	0802	FKEE	3 and 5	2	1 and 5	2
190	0241	FKEE	3 and 5	2	1 and 5	2
191	01853	FKEE	3 and 5	2	4 and 5	2
192	01849	FKEE	3 and 5	2	4 and 5	2
193	01315	FKEE	3 and 5	2	1 and 5	2
194	0801	FKEE	3 and 5	2	1 and 5	2
195	01066	FKEE	1 and 5	2	1 and 5	2
196	0055	FKEE	3 and 5	2	1 and 5	2
197	01052	FKEE	3 and 5	2	4 and 5	2
198	01356	FKEE	3 and 5	2	4 and 5	2
199	01154	FKEE	3 and 5	2	4 and 5	2
200	01156	FKEE	3 and 5	2	4 and 5	2
201	01346	FKEE	3 and 5	2	4 and 5	2
202	0629	FKEE	3 and 5	2	1 and 5	2
203	01317	FKEE	3 and 5	2	4 and 5	2
204	0049	FKEE	3 and 5	2	4 and 5	2
205	0045	FKEE	3 and 5	2	1 and 5	2
206	1373	FKKSA	1 and 5	2	1 and 5	2
207	0749	FKKSA	1 and 5	2	3 and 5	2
208	0336	FKKSA	1 and 5	2	1 and 5	2
209	0313	FKKSA	1 and 5	2	1 and 5	2
210	1648	FKKSA	1 and 5	2	1 and 5	2
211	0126	FKKSA	1 and 5	2	1 and 5	2
212	0805	FKKSA	1 and 5	2	1 and 5	2
213	0441	FKKSA	1 and 5	2	1 and 5	2
214	0439	FKKSA	1 and 5	2	3 and 5	2
215	0360	FKKSA	1 and 5	2	1 and 5	2
216	1747	FKKSA	1 and 5	2	3 and 5	2
217	01022	FKKSA	1 and 5	2	3 and 5	2
218	0819	FKKSA	1 and 5	2	3 and 5	2

219	0456	FKKSA	1 and 5	2	3 and 5	2
220	01285	FKKSA	1 and 5	2	1 and 5	2
221	0322	FKKSA	1 and 5	2	1 and 5	2
222	01111	FKKSA	1 and 5	2	3 and 5	2
223	0076	FKKSA	1 and 5	2	3 and 5	2
224	0179	FKKSA	1 and 5	2	1 and 5	2
225	01646	FKKSA	1 and 5	2	3 and 5	2
226	0118	FKKSA	1 and 5	2	1 and 5	2
227	0586	FKKSA	1 and 5	2	3 and 5	2
228	01392	FKKSA	1 and 5	2	3 and 5	2
229	0542	FKKSA	1 and 5	2	3 and 5	2
230	01352	FKKSA	1 and 5	2	3 and 5	2
231	0450	FKKSA	1 and 5	2	1 and 5	2
232	0532	FKKSA	1 and 5	2	1 and 5	2
233	01411	FKKSA	1 and 5	2	3 and 5	2
234	0538	FKKSA	1 and 5	2	1 and 5	2
235	0174	FKKSA	1 and 5	2	1 and 5	2
236	0696	FKKSA	1 and 5	2	3 and 5	2
237	0341	FKASA	2 and 5	2	1 and 5	2
238	0283	FKASA	2 and 5	2	1 and 5	2
239	01569	FKASA	2 and 5	2	1 and 5	2
240	0092	FKASA	2 and 5	2	1 and 5	2
241	0075	FKASA	1 and 5	2	1 and 5	2
242	2286	FKASA	2 and 5	2	3 and 5	2
243	01474	FKASA	2 and 5	2	3 and 5	2
244	2246	FKASA	1 and 5	2	1 and 5	2
245	01836	FKASA	2 and 5	2	3 and 5	2
246	01676	FKASA	2 and 5	2	3 and 5	2
247	1674	FKASA	2 and 5	2	1 and 5	2
248	01808	FKASA	2 and 5	2	3 and 5	2
249	01562	FKASA	1 and 5	2	1 and 5	2
250	01804	FKASA	2 and 5	2	3 and 5	2

251	01617	FKASA	2 and 5	2	3 and 5	2
252	0682	FKASA	2 and 5	2	3 and 5	2
253	01500	FKASA	2 and 5	2	1 and 5	2
254	0659	FKASA	2 and 5	2	3 and 5	2
255	0689	FKASA	1 and 5	2	3 and 5	2
256	0169	FKASA	1 and 5	2	3 and 5	2
257	0662	FKASA	2 and 5	2	3 and 5	2
258	0736	FKASA	2 and 5	2	1 and 5	2
259	0693	FKASA	1 and 5	2	1 and 5	2
260	0515	FKASA	2 and 5	2	3 and 5	2
261	0685	FKASA	2 and 5	2	3 and 5	2
262	0342	FKASA	1 and 5	2	1 and 5	2
263	0371	FKASA	2 and 5	2	1 and 5	2
264	0435	FKASA	2 and 5	2	3 and 5	2
265	0279	FKASA	2 and 5	2	3 and 5	2
266	0162	FKASA	2 and 5	2	3 and 5	2
267	285	FKASA	1 and 5	2	1 and 5	2
268	1232	FKASA	2 and 5	2	1 and 5	2
269	0306	FKM	1 and 5	2	1 and 5	2
270	0607	FKM	1 and 5	2	1 and 5	2
271	0663	FKM	1 and 5	2	2 and 5	2
272	0666	FKM	1 and 5	2	2 and 5	2
273	01583	FKM	1 and 5	2	2 and 5	2
274	01610	FKM	1 and 5	2	2 and 5	2
275	1966	FKM	1 and 5	2	2 and 5	2
276	0652	FKM	1 and 5	2	2 and 5	2
277	2093	FKM	1 and 5	2	1 and 5	2
278	1486	FKM	1 and 5	2	1 and 5	2
279	1984	FKM	1 and 5	2	2 and 5	2
280	0213	FKM	1 and 5	2	2 and 5	2
281	0612	FKM	1 and 5	2	2 and 5	2
282	0817	FKM	1 and 5	2	1 and 5	2

283	0992	FKM	1 and 5	2	2 and 5	2
284	0624	FKM	1 and 5	2	2 and 5	2
285	01681	FKM	1 and 5	2	2 and 5	2
286	01774	FKM	1 and 5	2	2 and 5	2
287	01778	FKM	1 and 5	2	2 and 5	2
288	0292	FKM	1 and 5	2	2 and 5	2
289	0367	FKM	1 and 5	2	2 and 5	2
290	2078	FKM	1 and 5	2	1 and 5	2
291	01565	FKM	1 and 5	2	1 and 5	2
292	0529	FKM	1 and 5	2	1 and 5	2
293	1895	FKM	1 and 5	2	1 and 5	2
294	0282	FKM	1 and 5	2	1 and 5	2
295	0137	FKM	1 and 5	2	1 and 5	2
296	0630	FKM	1 and 5	2	1 and 5	2
297	0305	FKM	1 and 5	2	1 and 5	2
298	0575	FKM	1 and 5	2	2 and 5	2
299	0738	FKM	1 and 5	2	1 and 5	2
300	1038	FKM	1 and 5	2	1 and 5	2

5.4 RESEARCH CONSTRAINTS

A few constrains happened during process of completing this research. The main constraint would be the prototype constraint cannot be fully implement. This due to the schedule of faculty involved in each session and the capacity for each session.

5.5 FUTURE WORKS

More constraints that can be added into this method. Hills climbing method will generate and test algorithm as it takes the feedback from test procedure that will utilize by the generator in deciding the next move in search space. The greedy approach also used this method.

REFERENCES

1- Selman, B., & P. Gomes, C. Hill-climbing Search, 333-336.

2- Du, K., & Swamy, M. (2016). Simulated Annealing. In Search and Optimization by Metaheuristics Technique and Algorithms Inspired by Nature (pp. 29-36). Switzerland: Springer International Publishing.

3- Naama, B., Bouzeboudja, H., & Allali, A. (2013). Application of tabu search and genetic algorithm in minimize losses in power system. Using the b-coefficient method. In TerraGreen 13 International Conference 2013 - Advancements in Renewable Energy and Clean Environment (pp. 688-693). M'naouar, Oran: Elsevier Ltd.

4-Krasnogor, N., Aragón, A., & Pacheco, J. MEMETIC ALGORITHMS.

5-Wang, D., Xiong, H., & Fang, D. (2016). A Neighborhood Expansion Tabu Search Algorithm Based On Genetic Factors.

6-Gupta, T., & Deshpande, A. IE510 Term Paper: Stochastic Gradient Descent, Weighted Sampling, and the Randomized Kaczmarz Algorithm.

7-Sabuncuoglu, I., & Bayiz, M. (1999). Job shop scheduling with beam search. European Journal Of Operational Research, 118(2), 390-412. http://dx.doi.org/10.1016/s0377-2217(98)00319-1