Introduction of the exam timetabling system education essay

Education

The literature reappraisal will concentrate on the debut of the test timetabling system that has been used in universities and timetabling that usage in other field and their job. Educational timetabling optimisation is a major administrative activity for a broad assortment of establishments. A timetabling optimisation job can be defined as delegating a figure of events into a limited figure of clip periods to optimise the consequence in the timetable to salvage cost, clip, infinite or other thing that can be save.

This study besides reviews the technique that can be used in optimising the fresh category in exam timetabling.

2. 1 PROBLEM DOMAIN

`` A. Wren (1996) defines timetabling is the allotment, capable to restraints, of given resources to objects being placed in infinite clip, in such a manner as to fulfill every bit about as possible a set of desirable aims (Burke & A ; Petrovic, 2002) .

Many research workers has part in timetabling jobs in several old ages subsequently due to the fact that timetabling jobs are frequently over-constrained, dynamic, and optimisation standards are difficult to specify. Some of the parts from those research workers are including graph colouring, whole number scheduling from Operations Research, simulated tempering, taboo hunt, familial algorithms, and restraint logic programming fromArtificial Intelligence(Alashwal & A ; Deris, 2007) .

Timetabling is produced by the programming job and it can be shown in many different signifiers. Timetabling is really of import to Business Company, organisation, or even to single. With timetable the work will go

more systematic and efficient. Timetabling is ongoing and uninterrupted procedure. A procedure of updating timetables is needed consideration of a important figure of objects and restraints. As increasing a figure of pupils, an updated to the current traditional timetabling system should be done from clip to clip to do the executable programming to pupils. Therefore, it takes a batch of clip such as several yearss or even hebdomads to finish scheduling timetables manually by homo.

A timetabling job is about an assignment of a set of activities, actions or events at specific clip slot for illustration: work displacements, responsibilities, categories to a set of resources. Timetabling jobs is related to jobs on allotment resources to specific seasonableness which there are specific restraints must be considered. The resources such as groups and topics are allocated to a clip slot of schoolrooms every bit long as it was fulfilling their restraints (Norberciak, 2006) .

This undertaking chief end is to bring forth a best consequence of delegating pupil to a category that will optimise the used categories. The trouble is due to the great complexness of the building of timetables for test, due the scheduling size of the scrutinies and the high figure of restraints and standards of allotment, normally circumvented with the usage of small rigorous heuristics, based on solutions from old old ages. The aim of this work is the scrutiny agendas. The chief intent is to apportion each concluding test paper to the best category based on the figure of pupil taking the paper, automatically by utilizing computing machines.

The people confronting these troubles is the people who in charge of delegating these exam manually. The variable is the day of the month of the test, clip of the test, topics, test documents, figure of pupil taking the exam paper and the available category. They need to group this test in test day of the month and clip of the test which is in forenoon or eventide. After that they will delegate each exam paper to an available category that fitted to the figure of pupil taking the test. These stairss will go on until all the test documents have their categories.

2. 2 Technique THAT CAN BE USED IN THE PROJECT

There are many intelligent techniques or method of optimisation that has been tried throughout the decennaries since the first efforts of automatizing the scrutiny timetabling procedure such as Particle Swarm Optimization (PSO) , Artificial Immune Algorithm, Graph Coloring Method and Genetic Algorithm.

2. 2. 1 PARTICLE SWARM OPTIMIZATION (PSO)

Goldberg, Davis and Cheng says that PSO is different from other methodological analysiss that use natural development as the architecture while PSO is based on societal behaviour of development (S. C. Chu, Y. T. Chen & A ; J. H. Ho, 2006) . PSO use self-organisation and division of labour for distributed job work outing similar to the corporate behaviour of insect settlements, bird flocks and other carnal societies (D. R. Fealco, 2005) .

Harmonizing to Kennedy and Eberhart (2001) , PSO comparatively new stochastic GO which is known as Global Optimization member if the Broader

Swarm intelligence field for work outing optimisation job (D. R. Fealco, 2005) .

PSO utilizing population of atom procedure to seek the system so each atom is updated by following two best values in every loop (S. C. Chu, Y. T. Chen & A ; J. H. Ho, 2006) . Optimization job in PSO is done by delegating way vectors and speeds to each point in a multi-dimensional hunt infinite and Each point so 'moves ' or 'flies ' through the hunt infinite following its speed vector, which is influenced by the waies and speeds of other points in its vicinity to localised loops of possible solution (C. Jacob & A ; N. Khemka, 2004) .

Algorithm

The PSO algorithm works at the same time keeping several candidate solution in the hunt infinite. PSO algorithm consist of seven measure (C. Jacob & A ; N. Khemka, 2004) . Which is

Initialize the population - locations and speeds.

Measure the fittingness of the single atom (pBest) .

Keep path of the persons highest fittingness (gBest) .

Modify speeds based on pBest and gBest place.

Update the atoms place.

Terminate if the status is meet.

Travel to Step 2.

The item of the PSO algorithm is shown in Figure 2. 1.

Figure 2. 1: The procedure of PSO

2. 2. 2 ARTIFICIAL IMMUNE ALGORITHM

Artificial Immune Algorithm besides known as AIS are stimulated from nature of human immune system. Dasgupta, Ji and Gonzalez reference that characteristic extraction, pattern acknowledgment, memory and its distributive nature provide rich metaphor for its unreal opposite number are the powerful capablenesss of the immune system (H. Yulan, C. H Siu & A ; M. K Lai) . Timmis & A ; Jonathan (2000) depict the AIS used natural immune system as the metaphor as the attack for work outing computational job (M. R. Malim, A. T. Khadir & A ; A. Mustafa) . Anomaly sensing, pattern acknowledgment, computing machine security, mistake tolerance, dynamic environments, robotic, informations excavation optimisation and programming are the chief sphere application of AIS (M. R. Malim, A. T. Khadir & A ; A. Mustafa) .

Some preliminary biological footings in order to understand the AIS are immune cells B-cells and T-cells are two major group of immune cell and it help in acknowledging an about illimitable scope of anti cistrons form and antigens (AG) is the disease-causing component, it has two type s of antigens which is self and non-self where non-self antigens are disease-causing elements and self anti-genes are harmless to the organic structure (R. Agarwal, M. K. Tiwari, S. K. Mukherjee, 2006) .

There are two chief application sphere in AIS which is antigen and antibody. Antigen is the mark or the solution for the job, while the antibody is the reminder of the informations. Occasionally, there are more than one antigen at a certain clip and there are often big figure of antibodies present at one time. Generic stairss of unreal immune system (AIS) :

Measure 1: Define job specific nonsubjective map and set the algorithm

parametric quantity. Set iter= 0 ; counter for figure of loops. Generate initial

executable random solutions. (Here solution represents operation precedence

figure matching to each activity) .

Measure 2: Randomly choose an antigen and expose to all antibodies. Calculate the

affinity of all antigens and make affinity vector Af. (In our instance to

calculate affinity, first optimal/near optimum agendas of activities are

determined with the aid of precedence figure as give in Section 3. 3

thenceforth ; its make p value is calculated) .

Measure 3: Choice Pc highest affinity antibodies. Generate the set of ringers for the

selected antibodies.

Measure 4: For each generated ringer do inverse mutant (choose a part of ringer

twine and invert) with a chance and cipher the affinity of the new

solution formed. If affinity (new solution) & gt ; affinity (ringer) so clone= new

solution ; else do partner off wise interchange mutant (choice any two location

and inter- alteration elements) . Calculate the affinity of the new solution

formed if affinity (new solution) & gt ; affinity (ringer) so clone= new solution ;

else, clone= clone.

Measure 5: Expose the new inhabitants of the society (i. e. , ringers) to the antigens. Check

for feasibleness and calculate affinity.

Measure 6: Replace the Ps lowest affinity antibodies with the Ps best ringers

generated. Iter= iter+1 ; if (iter & lt ; iter_max) goto measure 2 else Give the best

antibody as the end product.

The AIS flow chart is shown in Figure 2. 2.

Figure 2. 2: AIS flow chart

2. 2. 3 GRAPH COLORING METHOD

It is good known that the scrutiny timetabling job, when sing merely the scrutiny conflicts restraint, maps into an tantamount graph colourising job (Kiaer & A ; Yellen, 1992) , which is NP-complete (Burke, Elliman, & A ; Weare, 1993 ; Willemen, 2002) . The graph colouring job is an assignment of colourss to vertices in such a mode that no two next vertices have the same colour. Therefore, a solution to the graph colourising job represents a solution to the nucleus scrutiny timetabling job, where graph vertices correspond to exams, graph borders indicate that the affiliated vertices have an scrutiny struggle, and colourss represent alone clip slots (Welsh & A ; Powell, 1967) . The graph colourising job in bend is solved utilizing one of the graph colourising heuristics (e. g. , Largest Degree) , normally with backtracking (Burke, Newall, & A ; Weare, 1998 ; Carter, Laporte, & A ; Chinneck, 1994) .

Graph colouring is a particular instance of graph labeling. It is an assignment of labels traditionally called `` colourss '' to elements of a graph topic to certain restraints. In its simplest signifier, it is a manner of colourising the vertices of a graph such that no two next vertices portion the same colour ; this is called a vertex colouring. Similarly, an border colourising assigns a colour to each border so that no two adjacent borders portion the same colour, and a face colouring of a planar graph assigns a colour to each face or part so that no two faces that portion a boundary have the same colour (DR Hussein & A ; K. E. Sabri, 2006) .

Graph colouring is one of the most functional theoretical accounts in graph theory. It has been used to work out many jobs such as in school timetabling, computing machine registry allotment, electronic bandwidth allotment, and many other applications (Dr Hussein & A ; K. E. Sabri, 2006) . Dr Hussein and K. E. Sabri besides mention that Greedy Graph Coloring is one of the consecutive techniques for colourising a graph. They stated that the technique focuses on carefully select the following vertex to be colored. In their study they explain two common algorithm which is first tantrum and grade based telling techniques.

First tantrum: First Fit algorithm is the easiest and fastest technique of all greedy colourising heuristics. The algorithm consecutive assigns each vertex the lowest legal colour. This algorithm has the advantage of being really simple and fast and can be implemented to run in O (N) .

Degree based ordination: It provides a better scheme for colourising a graph. It uses a certain choice standard for taking the vertex to be colored. This scheme is better than the First Fit which merely picks a vertex from an arbitrary order. Some schemes for choosing the following vertex to be colored have been proposed such as:

Largest grade telling (LDO) : It chooses a vertex with the highest figure of neighbours. Intuitively, LDO provides a better colouring than the First Fit. This heuristic can be implemented to run in O (n2) .

Saturation grade telling (SDO) : The impregnation grade of a vertex is defined as the figure of its next otherwise colored vertices. Intuitively, this

heuristic provides a better colouring than LDO as it can be implemented to run in O (n3) .

Incidence grade telling (IDO) : A alteration of the SDO heuristic is the incidence grade telling. The incidence grade of a vertex is defined as the figure of its next coloured vertices. This heuristic can be implemented to run in O (n2) .

2. 2. 4 GENETIC ALGORITHM

The familial algorithms distinguish themselves in the field of methods of optimisation and hunt for the assimilation of the Darwinian paradigm of the development of species.

The familial algorithms are procedures of convergence (Queiros, 1995) . Its construction is governed by import Torahs of the theory of development of species and concreteness in two cardinal constructs: choice and reproduction. The confrontation between familial algorithms and the existent jobs is promoted by the demand for optimisation. It follows a infinite of tremendous dimensions, in which each point represents a possible solution to the job. In this labyrinth of solutions, merely a few, if non merely one, to the full satisfy the list of restraints that give form to the job.

The jobs of optimisation, normally associated with the satisfaction of restraints, specify a existence of solutions, go forthing the familial algorithm to find the overall solution, or a solution acceptable as a restriction on the clip of action of the algorithm.

The familial algorithms are search algorithms based on mechanisms of natural choice and genetic sciences. Normally used to work out optimisation jobs, where the infinite of hunt is great and conventional methods is inefficient (R. Lewis and B. Paechter, 2005) .

Characteristic

The nomenclature they are associated to interpret the import of indispensable constructs of genetic sciences and guesses the importance attributed to the interaction of these constructs. The construct of population, like figure of persons of the same species, is extended to unreal species. Persons are usually represented by sequences of Numberss: the genotype. The Numberss, or instead, a aggregation of Numberss, is the familial heritage of the person, finding their features, that is, its phenotype. The familial algorithms differ from traditional methods of research and optimisation, chiefly in four facets:

Work with a codification of the set of parametric quantities and non with their ain parametric quantities.

Work with a population and non with a individual point.

Uses information from or derive cost and non derived or other subsidiary cognition.

Uses regulations of passage chance and non deterministic.

The solutions interact, mix up and bring forth progeny (kids) trusting that retaining the features `` good '' of their rise (parents) , which may be seen

as a local hunt, but widespread. Not merely is the vicinity of a simple solution exploited, but besides the vicinity of a whole population.

The members of the population are called persons or chromosomes. As in natural development, the chromosomes are the basal stuff (practical, in this instance) of heredity. It presently uses a map of rating that associates each person, a existent figure that translates to version.

Then, in a mode straight relative to the value of their version, are selected braces of chromosomes that will traverse themselves. Here, can be considered the choice with elitism, or guarantee that the best solution is portion of the new coevals.

His crossing is the consequence of unreal choice, sing more altered those that best run into the specific conditions of the job. The crossing of the numerical sequences promotes the outgrowth of new sequences, formed from the first. With a chance established, after traversing, a mutant can go on, where a cistron of chromosome alterations.

These new persons are the 2nd coevals of persons and grade the terminal of rhythm of the familial algorithm. The figure of rhythms to execute depends on the context of the job and the degree of quality (partial or full satisfaction of the limitations) , which is intended for the solution.

2. 2. 4. 1 A SIMPLE GENETIC ALGORITHM DESCRIBES THE FOLLOWING CYCLE

There are eight measure in familial algorithm rhythm which is:

Coevals of random n chromosomes that form the initial population.

Appraisal of each person of the population.

Confirmation of the expiration standards.

If verify expiration standard - rhythm stoping.

Choice of n/2 braces of chromosomes for crossing over.

Reproduction of chromosomes with recombination and mutant.

New population of chromosomes called new coevals.

Travel back to step 2.

The rhythm described above is illustrated in Figure 2. 1.

Fig. 2. 1. Basic construction of the familial algorithm

Low-level formatting

Initially many single solutions are indiscriminately generated to organize an initial population. The population size depends on the nature of the job, but typically contains several 100s or 1000s of possible solutions. Traditionally, the population is generated indiscriminately, covering the full scope of possible solutions (the hunt infinite) . Occasionally, the solutions may be seeded in countries where optimum solutions are likely to be found (R. Lewis and B. Paechter, 2005) .

Choice

During each consecutive coevals, a proportion of the bing population is selected to engender a new coevals. Individual solutions are selected

through a fitness-based procedure, where fitter solutions (as measured by a fittingness map) are typically more likely to be selected. Certain selection methods rate the fittingness of each solution and preferentially choose the best solutions. Other methods rate merely a random sample of the population, as this procedure may be really time-consuming (R. Lewis and B. Paechter, 2005) .

Most maps are stochastic and designed so that a little proportion of less fit solutions are selected. This helps maintain the diverseness of the population big, preventing premature convergence on hapless solutions. Popular and well-studied choice methods include roulette wheel choice and tournament choice (R. Lewis and B. Paechter, 2005) .

Reproduction

The following measure is to bring forth a 2nd coevals population of solutions from those selected through familial operators: crossing over (besides called recombination) , and/or mutant.

For each new solution to be produced, a brace of `` parent '' solutions is selected for engendering from the pool selected antecedently. By bring forthing a `` kid '' solution utilizing the above methods of crossing over and mutant, a new solution is created which typically portions many of the features of its `` parents '' . New parents are selected for each new kid, and the procedure continues until a new population of solutions of appropriate size is generated. Although reproduction methods that are based on the usage of two parents are more `` biologicalsciencedivine '' , some research

suggests more than two `` parents '' are better to be used to reproduce a good quality chromosome (R. Lewis and B. Paechter, 2005) .

These processes finally consequence in the following coevals population of chromosomes that is different from the initial coevals. By and large the mean fittingness will hold increased by this process for the population, since merely the best being from the first coevals are selected for genteelness, along with a little proportion of less fit solutions, for grounds already mentioned above.

Termination

This generational procedure is repeated until a expiration status has been reached (R. Lewis and B. Paechter, 2005) . Common terminating conditions are:

A solution is found that satisfies minimal standards.

Fixed figure of coevalss reached.

Allocated budget (calculation time/money) reached.

The highest superior solution 's fittingness is making or has reached a tableland such that consecutive loops no longer bring forth better consequences.

Manual review.

Combinations of the above.

2. 3 Related Work

2. 4 Summary

Familial Algorithm is the best algorithm in timetabling job. The consequences in GAs are better optimized than the traditional method based on try-check rules on scheduling system. Some research worker had different sentiment on the advantages and disadvantages of these algorithms. Although there are new method on optimising consequence, GAs is still the chosen method in timetabling job.