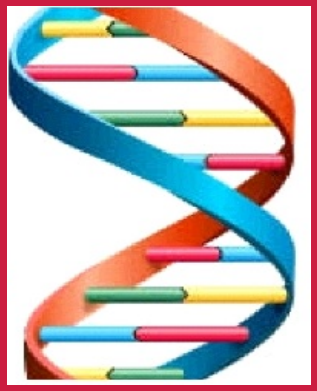
HYBRID ANT COLONY

GENETIC



COURSE TIMETABLE GENERATOR

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Done by
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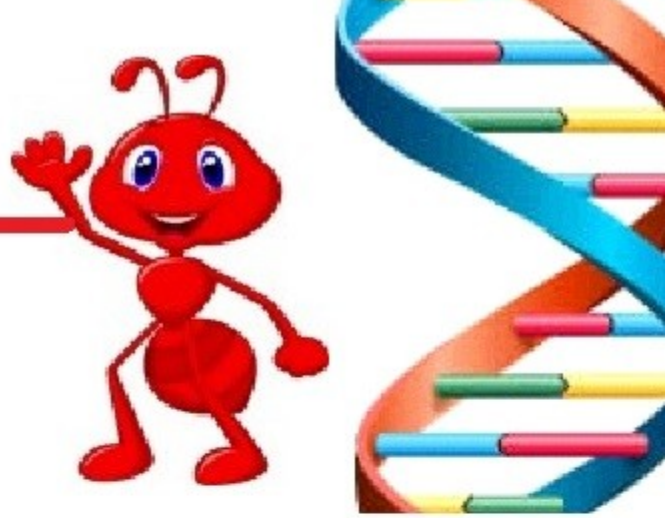
Anchu R S

OUTLINE:

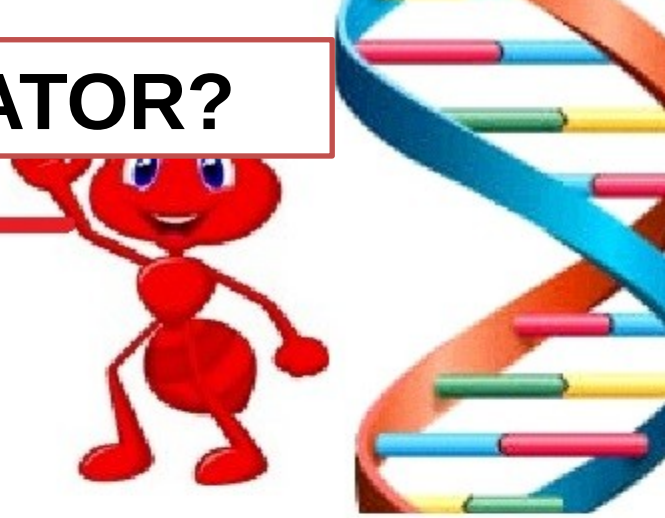


- Introduction
- Need for Timetable Generator
- Phases for Computation
- Input and Output Formats
- About timetabling problem
- Algorithm used
  - ➢Ant Colony algorithm
  - ➢Genetic algorithm
- Hybrid ant colony genetic algorithm
- Conclusion
- References

OBJECTIVE:

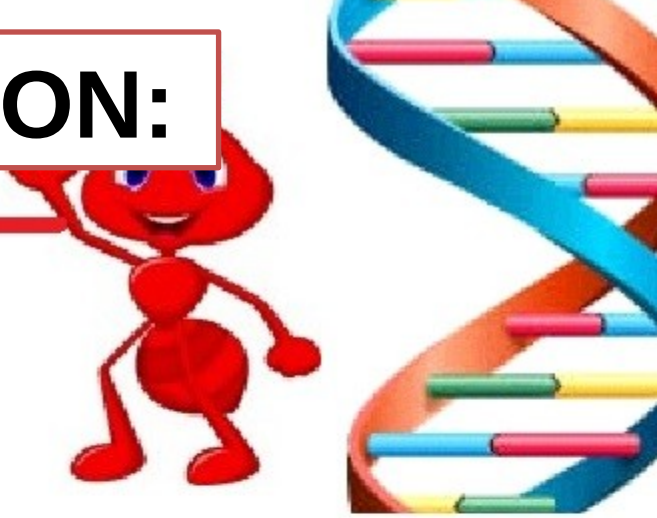
The main objective of this project is to develop a course timetable for B.Tech in Rajagiri School of Engineering and Technology satisfying all the constraints specific to the institution.

WHY OUR TIMETABLE GENERATOR?



1 and a half months to 3 minutes

PHASES FOR COMPUTATION:



Get Details in Excel sheets

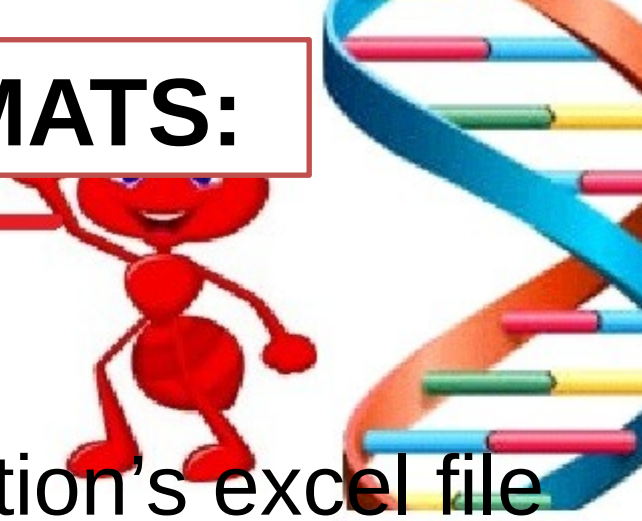
Extract details to data structures

Generate solutions

Optimise

TIME TABLE

INPUT AND OUTPUT FORMATS:



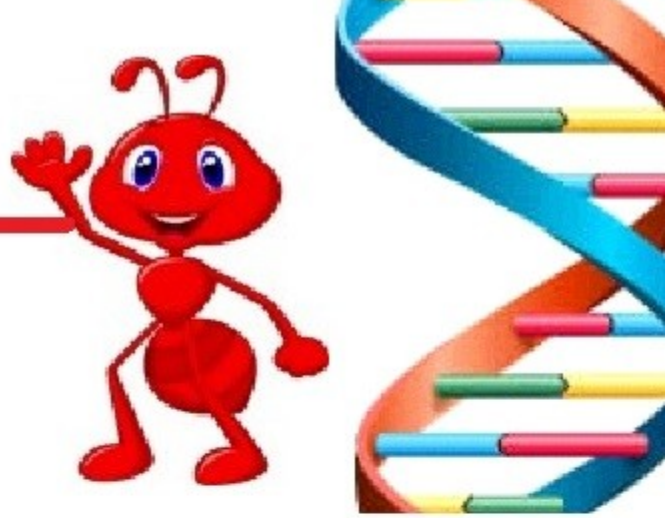
Input

- Teacher-Subject-Class allocation's excel file
- Syllabus details specification's excel file
- Prealloted lab hours' excel file

Output

- Timetable for a week for all classes generated in an excel sheet

ABOUT THE PROBLEM:



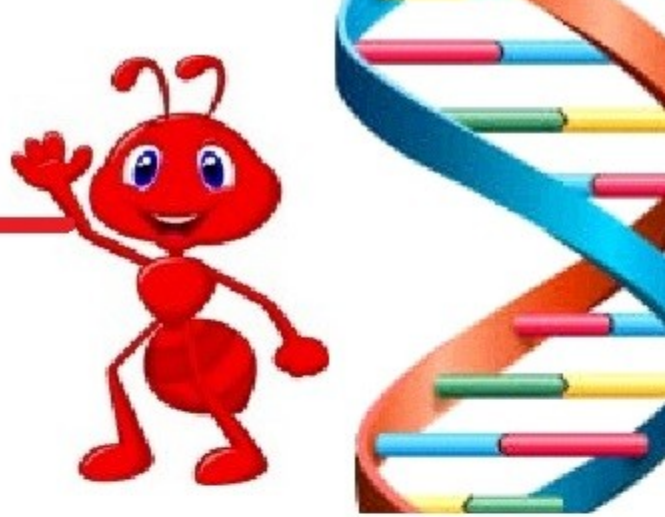
- NP-HARD
- No polynomial time solution can be found

HOW TO COMPUTE IN A POLYNOMIAL TIME?

Some Approaches
-Tabu Search
-Ant Colony Based Approach
-Genetic Algorithm

A solution close to optimal is obtained

ALGORITHM USED:

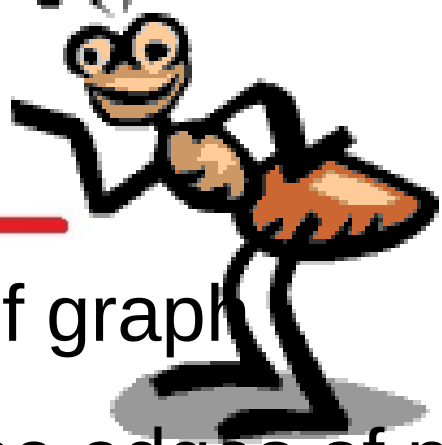


HYBRID ANT-COLONY GENETIC ALGORITHM

Ant colony generates inputs for optimisation

Genetic optimises and fixes the solution

ANT COLONY ALGORTHM



- Ants are agents that start from nodes of graph
- Each ant deposits pheromone along the edges of p

it chooses

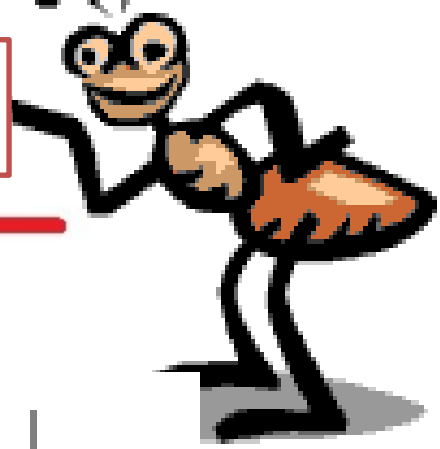
- Ants are more likely to take path with more

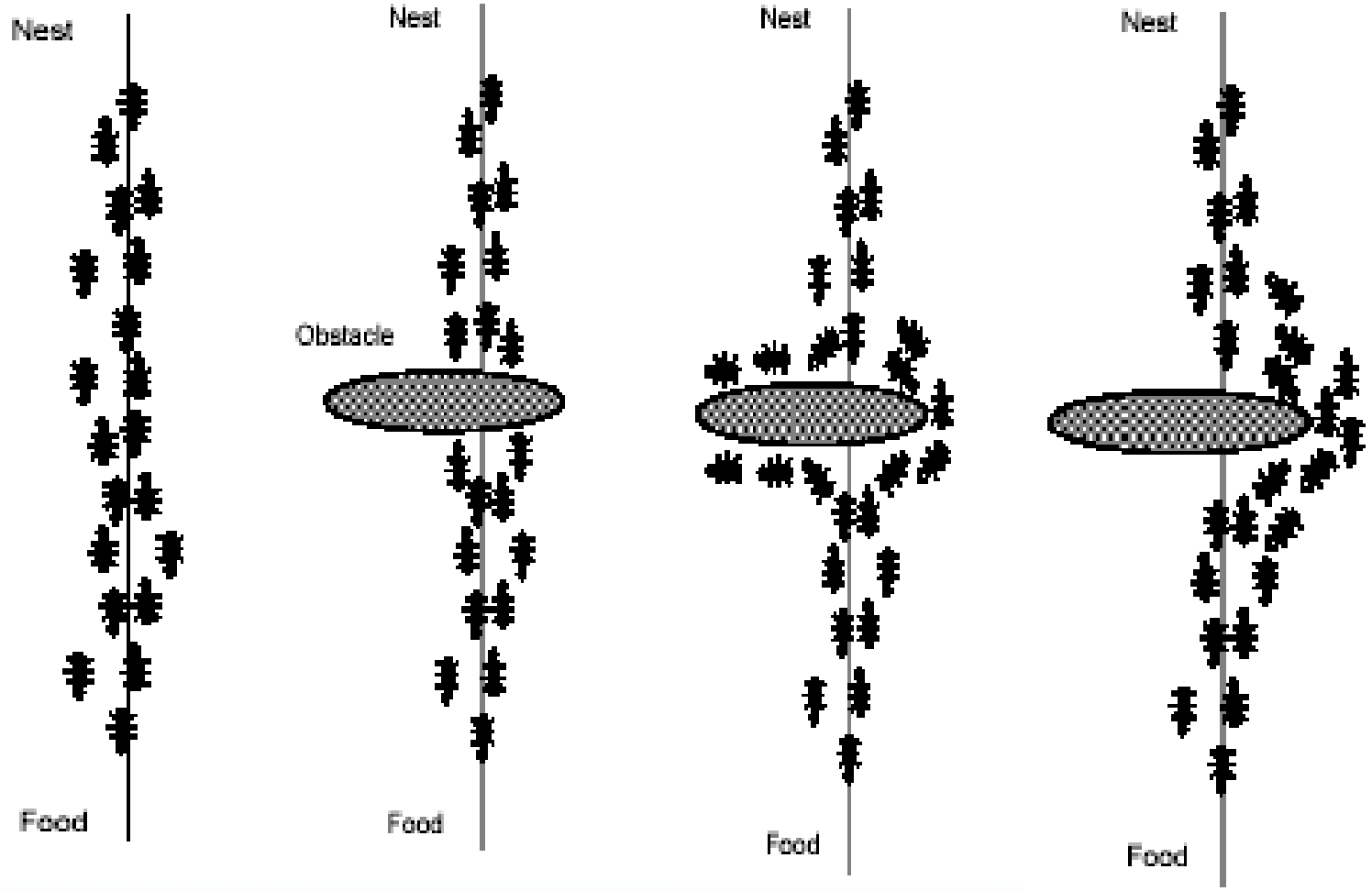
pheromones

in it

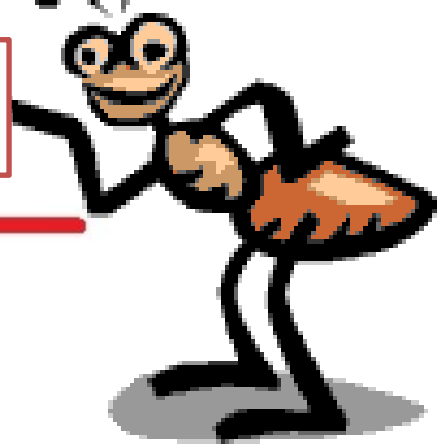
EVENTUALLY FOLLOWS THE OPTIMAL PATH

NATURAL BEHAVIOUR OF ANTS:





ANT COLONY ALGORITHM:



1.Initialise ants to the nodes of the graph

2.For each ants do

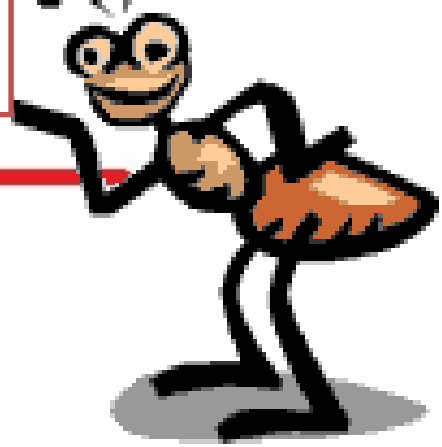
2.1Select next node for the ants to move with a good probability value

3. Repeat step 2 until the stopping criterion for an ant is met

4. Increment pheromones for the edges taken by the ant

5.Evaporate pheromones of all edges by an evaporation factor

ANT COLONY ALGORITHM:



$$PROBABILITY(i,j)=\frac{PHEROMONE(i,j)^{\alpha}*VISIBILITY(i,j)^{\beta}}{\Sigma\ PHEROMONE(i,j)^{\alpha}*VISIBILITY(i,j)^{\beta}}$$

GENETIC ALGORITHM

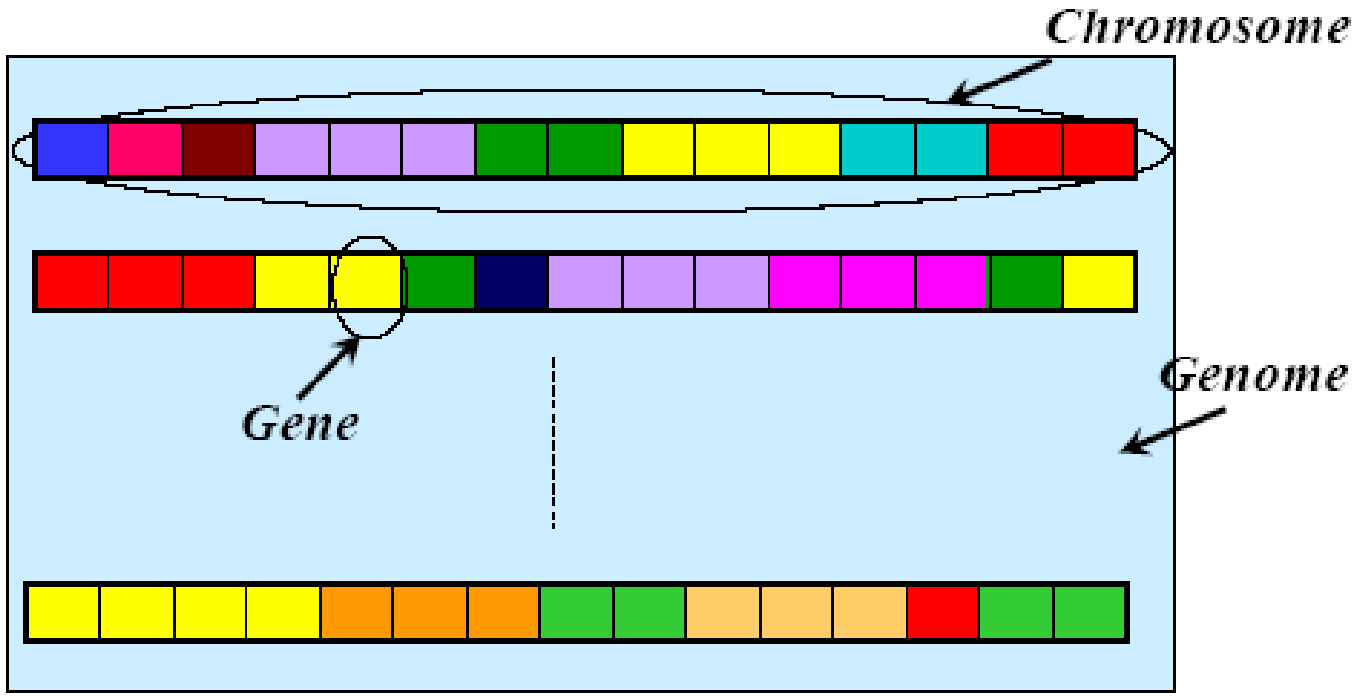
- Search algorithm using process of natural selection.

- Major components are:
  - Population
  - Fitness Function
- Individual element of the population

Chromosome

The Chromosome represents a potential solution and is divided into multiple **genes.**

GENETIC ALGORITHM



Genome - Collection of all *chromosomes*

GENETIC ALGORITHM

Basic Operations:

- Selection
- Crossover
- Mutation

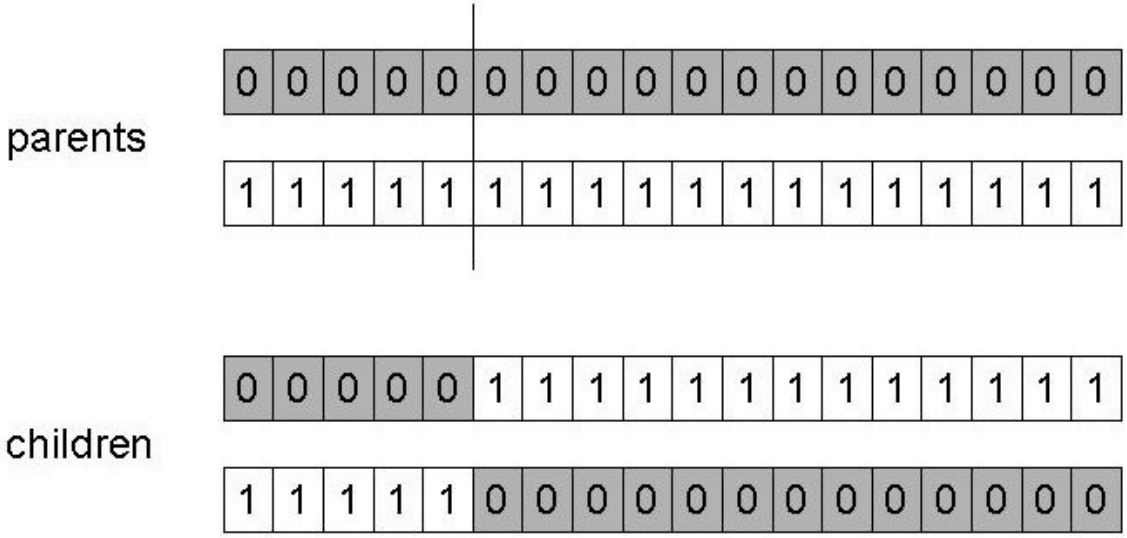
Selection :

selects the chromosome with maximum fitness for evolution

GENETIC ALGORITHM

Crossover:

- Choose a random point on 2 chromosomes
- Split parents at this crossover point
- Create children by exchanging gene



GENETIC ALGORITHM

Mutation:

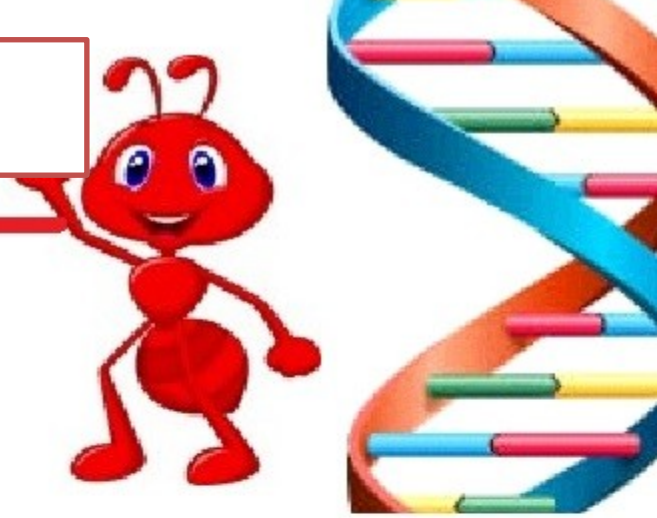
- Mutation is fairly simple
- just change the selected genes

parent	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
child	0	1	0	0	1	0	1	1	0	0	0	1	0	1	1	0	0	1

GENETIC ALGORITHM

Choose initial population
- Evaluate fitness of each individual
- Repeat
  - Select best-ranking individuals to reproduce
  - Breed new generation through crossover and mutation (genetic operations)
  - Evaluate the individual fitness of the offspring
  - Replace worst ranked part of population with offspring
- Until <terminating condition>

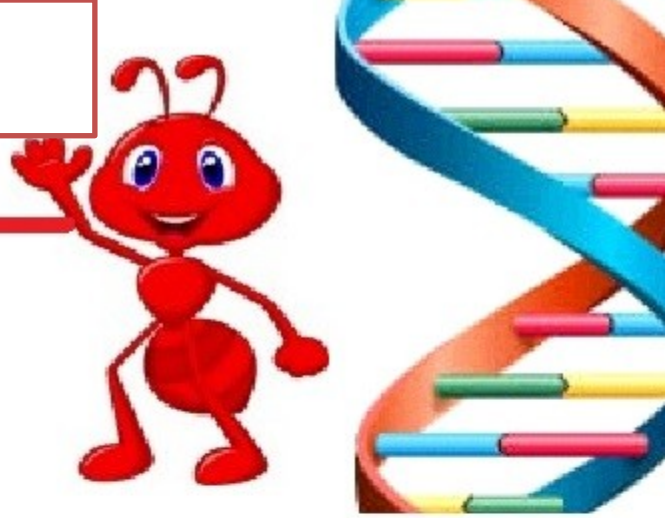
ANT COLONY INDETAIL:

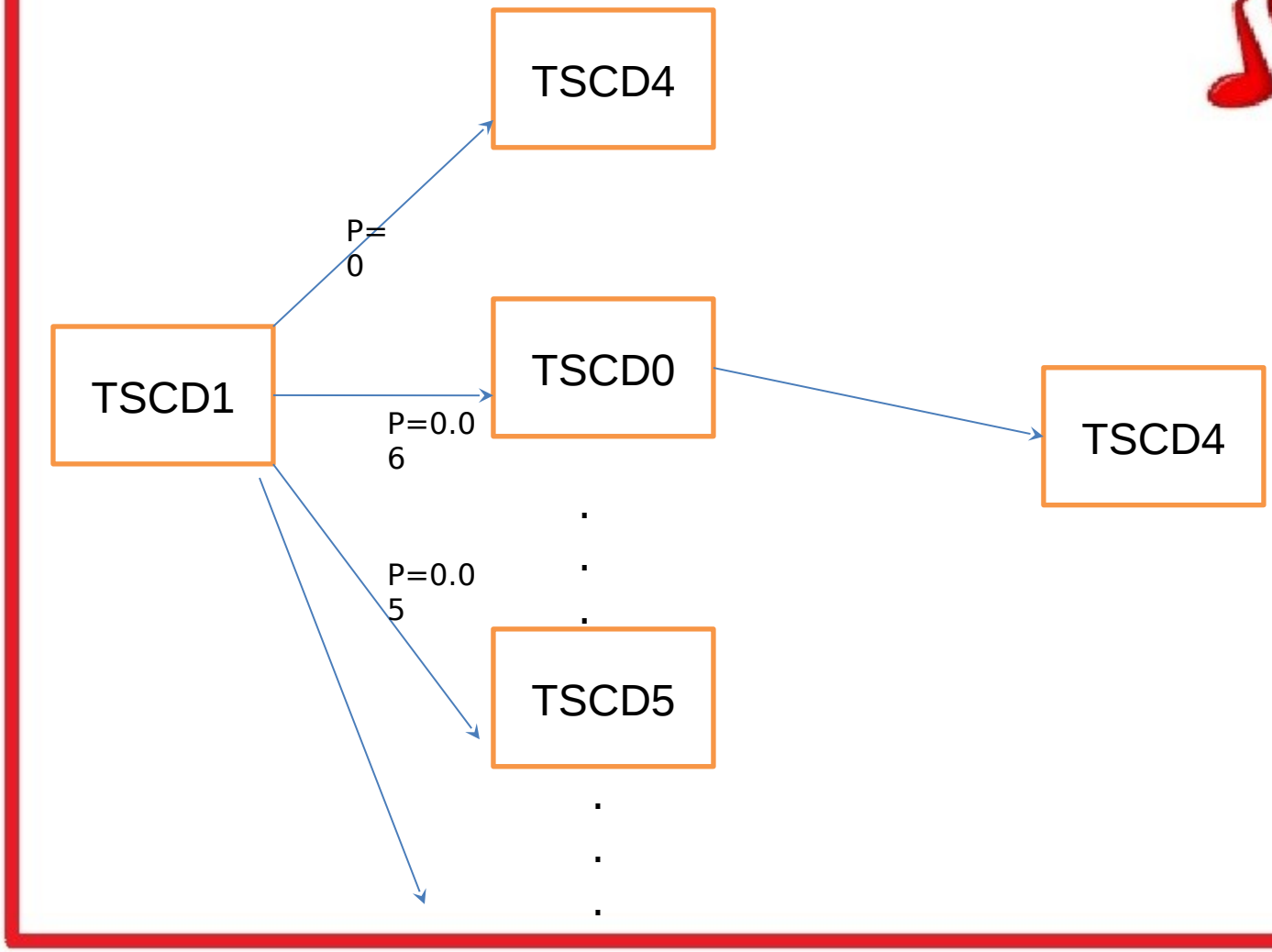


- CLASS
- SUBJECT
- ROOM
- TEACHER
- DAY
- HOUR

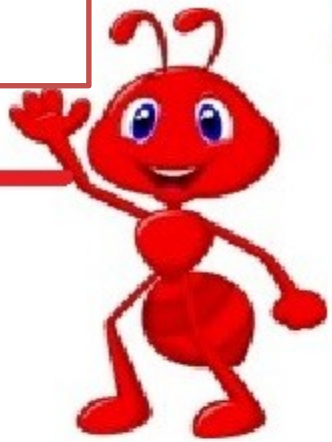
TSCD

ANT COLONY INDETAIL:





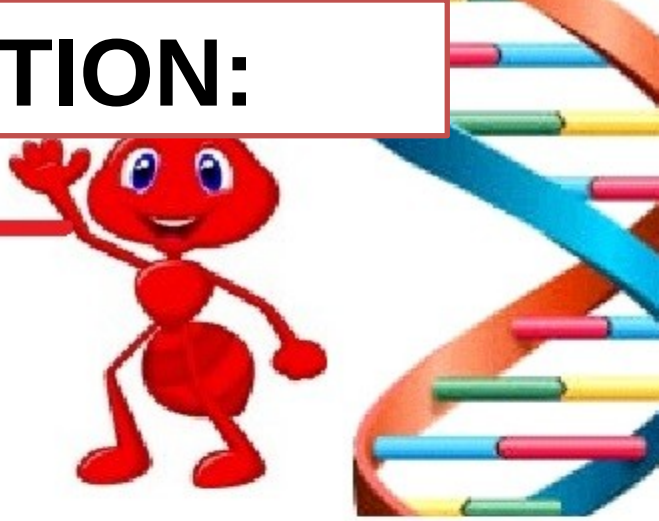
ANT COLONY INDETAIL:



ANT 1:

TSCD1	TSCD0	TSCD4	TSCD3	TSCD2	TSCD0	TSCD5

GRAPHICAL REPRESENTATION:



- Edges are between TSCD

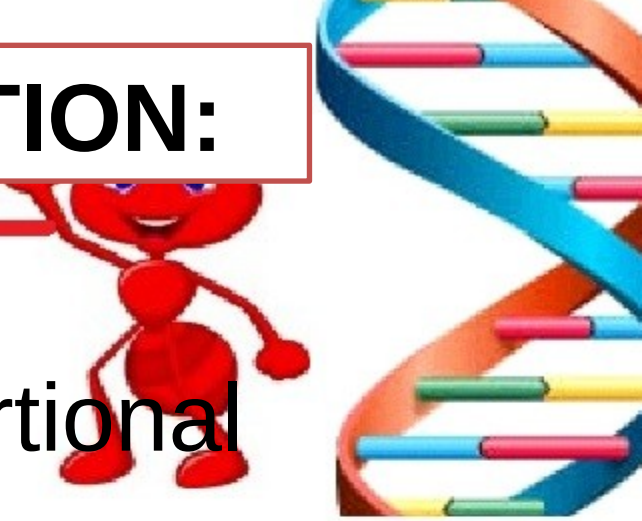
of an hour to TSCD of next hour

- Two data structures:

➢ Pheromone

➢ Distance

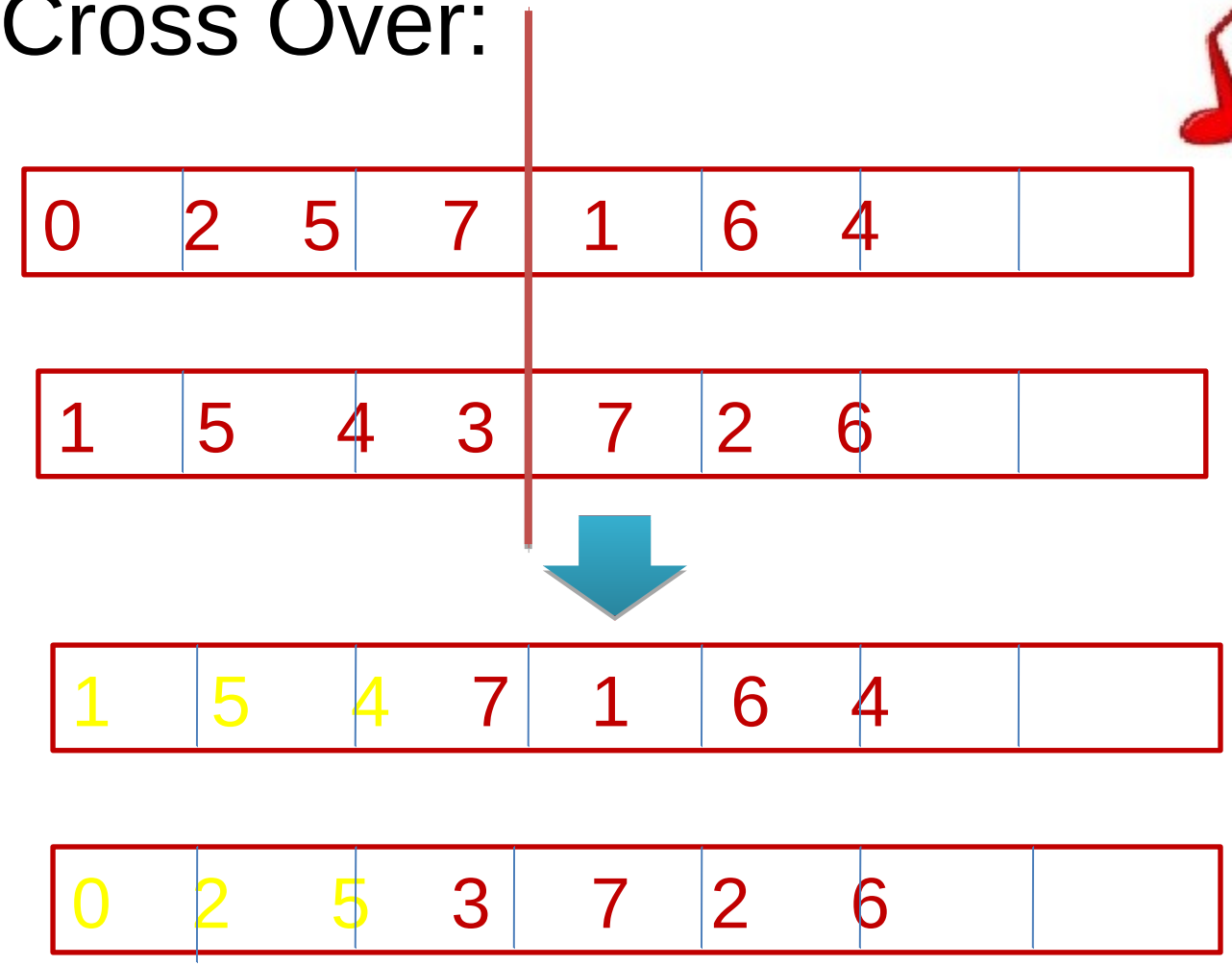
GRAPHICAL REPRESENTATION:



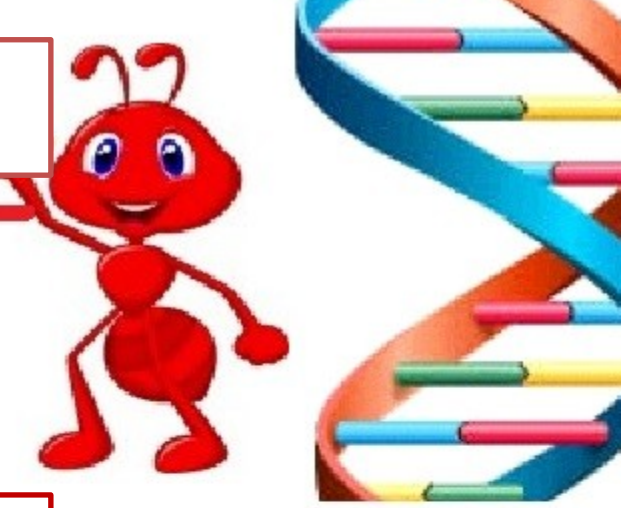
- Distance is inversely proportional to visibility
- Distance gives a measure of possibility of a subject following other
- Pheromone gives the possibility of a subject being allotted to a particular time slot

GENETIC OPERATIONS:

Cross Over:



GENETIC OPERATIONS:

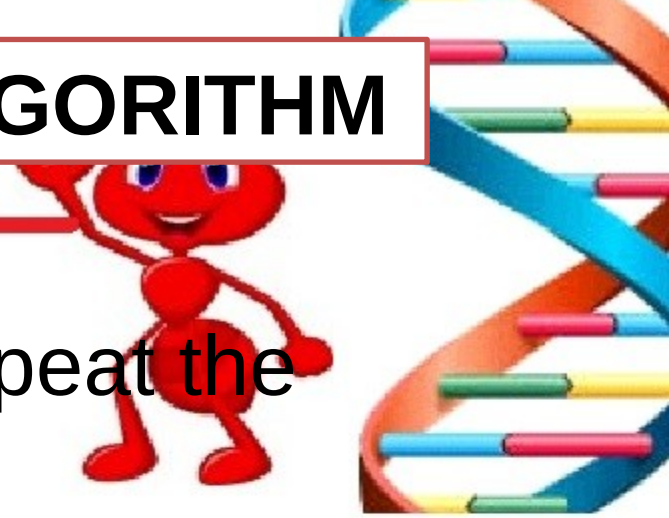


Mutation:

0	2	5	7	7	6	4		

1	3	5	7	2	6	4		

HYBRID ANT COLONY GA ALGORITHM



1.For each day of the week repeat the following steps

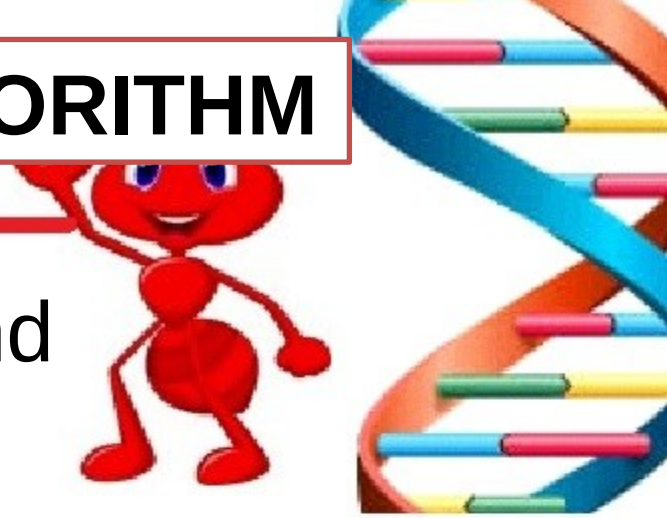
2.For each class repeat steps 3-10

3.Initialise pheromone and distance for each edge

4. Initialise initial position of 7 ants for 7 hours

5.Move all ants 7times and initialise chromosomes for genetic

HYBRID ANT COLONY GA ALGORITHM



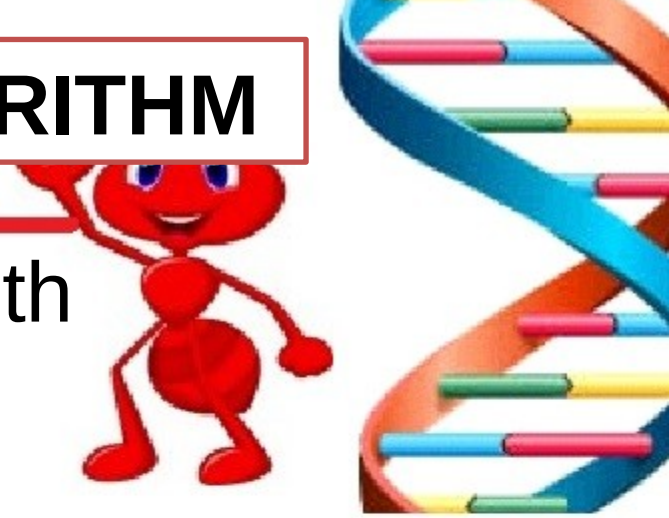
6. Update pheromone levels and evaporate pheromones

7.Repeat steps 4 to 6, n times(n chosen by the programmer)

8.Evaluate fitness of each chromosome

9.Repeat until fitness value reaches target

YBRID ANT COLONY GA ALGORITHM



9.1.Choose chromosomes with maximum fitness,n1,n2

9.2.Apply crossover on n1,n2

9.3.Evaluate fitness if meeting target exit

9.4.Mutate n1 and n2

9.5.Evaluate fitness if meeting target exit, Else add to pool if it meets validating criteria

10.Fix the chromosome as solution

CONCLUSION

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The implemented system for Timetable generation automates the task o timetable generation. It is scalable to add new constraints and for further future modifications.

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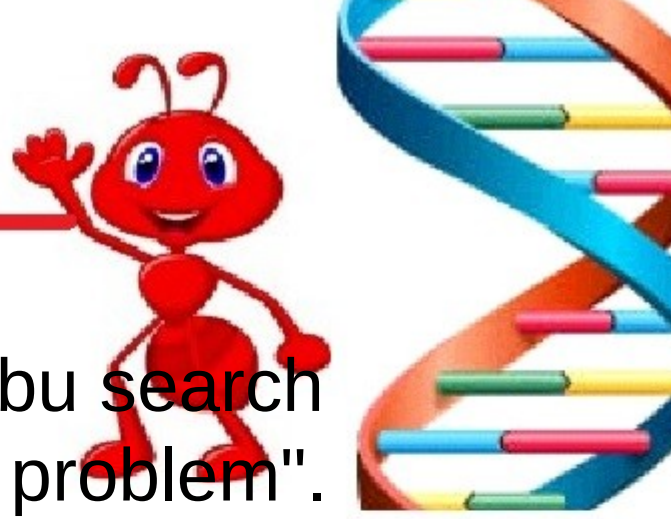

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