modelling & simulation lab

(I) What is Review paper?
(II) Diff. bet^n research article and review
(III) Benefits
(IV) How to write
(V) Tips for efficient writing

Review paper :- It is a ~~peate~~ piece of work based on previously published research article.

↳ Narrative review
↳ Thoughtful "

(3000 – 5000) size of review

Research paper

(i) Experiment, Analysis & Result Interpretation

(ii) Components:
- Abstract
- Introduction
- material / method
- Results
- Discussion
- Conclusion

Review paper

(i) Compilation & Analysis

(ii) Components:
- Abstract
- Background / Introduction
- Discussion
- Conclusion

Benefits of writing a Review

(i) To increase the citation

(ii) To emphasize the main point of research article/ paper.

↳ Suitable Topic & Relevance

↳ outline
↳ Gather information.
↳ Target a suitable Journal
↳ Start writing based on outline
↳ refer the published article.

→ Background
→ purpose
→ Deliverables
→ challenges
→ Gaps
→ Correlation
→ Inferences
→ Direction

(i) Simplify
(ii) Table/figures
(iii) Stay focused.
(iv) Rough Draft first.
(v) persist.

. Cite & manage
Use mendeley, endnote.

→ Revise thoroughly
→ ref checked.

How to write a review paper?

Important terms
- ↳ literature survey → year, citation
- ↳ literature Review
- ↳ literature outcomes

Title page :

1. Title
2. Affiliations
3. Abstract
4. keywords

1. Title :-

Title — (8–15) words

Eg, A review of challenges & solutions in the preparation and use of magnetorheological fluids
↑ 14 words

Vibration control of civil structure using piezoceramic smart materials: A review
↑ 11 words

A study on properties & selection criteria for magneto Rheological (MR) fluid components.

↑ ±3 words

2 Affiliations

Bhau K. Kumbhar[1], Satyajit R. Patil[2]

70% weightage 30% weightage

[1,2] Department of Automobile Engineering, Rajarambapu Institute of Technology, Sakharale, Sangli, 415 414, India

* Corres. Author: bkumbhar2050@gmail.com

3 Abstract (Total words >= 130)
↳ Importance & introduction
↳ General methodology (summary)
↳ your contribution
↳ Implications of your research

4 Keywords
4 to 8 important keywords.

5 Introduction
↳ 1 or 2 paragraph

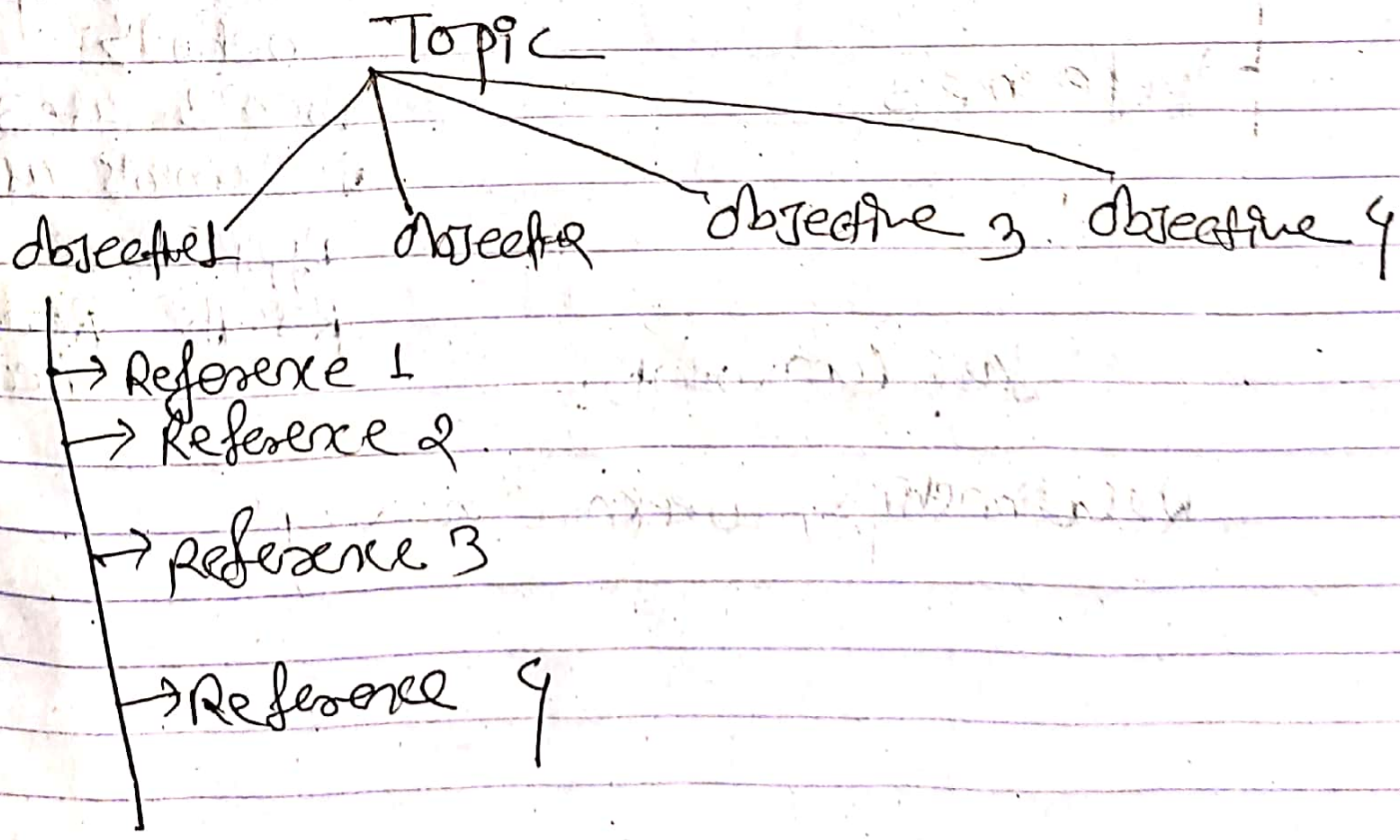
6 writing & organizing literature
↳ major concepts ?
↳ methods used ?
↳ Theories Investigated ?
↳ Instruments used ?
↳ Applications ?
↳ Results ?

Important Steps to follow

↳ use of proper citations.
↳ status & Accomplishments
↳ Identify weekness & Gaps
↳ your Comments with Critical thinking.

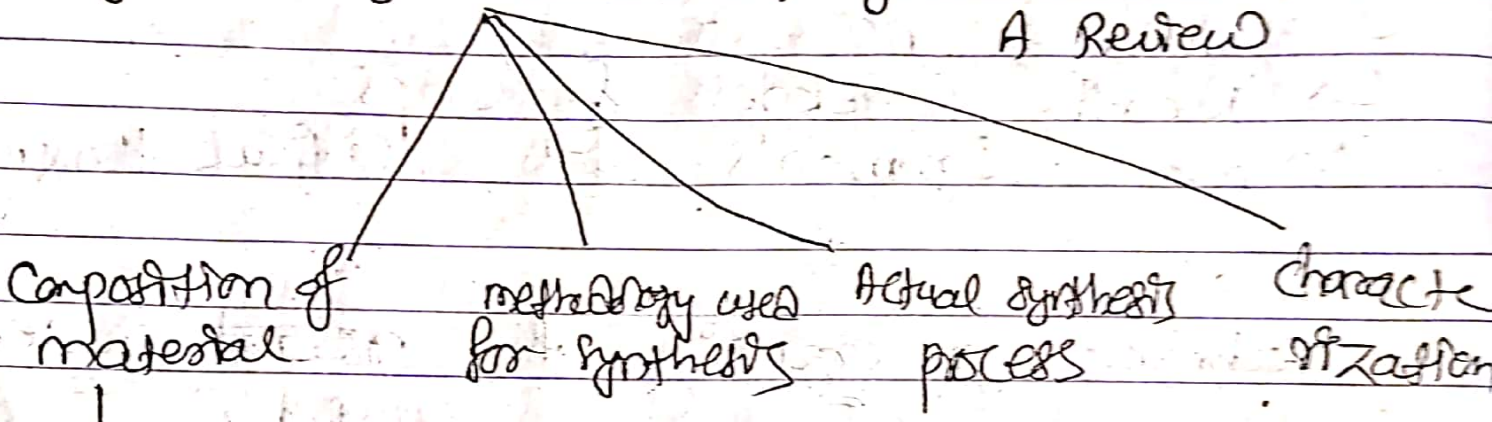
Technique for organizing the ~~research~~ review paper

Technique : 1



Eg

Synthesis & characterization of a smart materials: A Review



- Reference 1
- Reference 2
- Reference 3

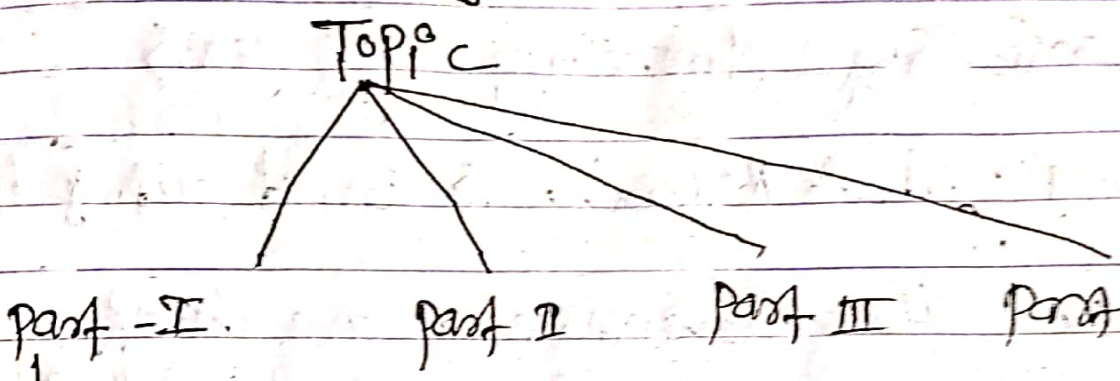
Imp. points in Analysis
- major Concepts
- methods
- Theories used
- Instruments used
- Applications
- Results
- Reviewed

Your Comments:

Relationships, weekness or Gaps

Technique 2 :-

Grouping in tables charts etc. . . .



→ Tables

→ Charts

→ your Analysis or Comments.

Summary of Relationships of all parts

Technique : 3
To make use of chronology

Eg Considering chronology of years

2005 - 2009 : what Research is carried out & how?

2010 - 2014 : How advancements are done?

2015 - 2019 : what new technology is opted?

2020 - 2024 : what are the future challenges?

mendeley

Reference styles with disciplines

APA → psychology, education.
chicago B → sciences
IEEE → engineering, IT

Rejection

I) preliminary stage
↳ formating Requirements
↳ language
↳ novelty (newness, originality)
↳ Theme of the Journal

II) Revision stage

Grammar checker

scribens

(I) spelling
(II) Grammar
(III) punctuation
(IV) & fluency
(V) Readability
(VI) word choice
(VII) plagiarism detection
(VIII) inclusive language
(IX) formality level
(X) Additional advanced Correct-ions.

smallseotools

Review paper format

Title page:
Title -- reflecting topic of review
Your name
Date

Abstract :- (200 - 300) words. Provide the brief summary of the review question being addressed or rationale for the review, the major studied reviewed, and conclusion drawn. Please do not cite references in the abstract.

Introduction :- Introduce the topic & your rationale for addressing this topic focusing on why this topic is important. Clearly define exactly what this article will discuss, outline the order in which you will discuss each subtopic to give the reader any background information needed to understand the coming sections.

Body (subtopics being addressed.) :- Although the structure may vary based on the sub-topics or review questions being addresses. for example, if you reviewing three diff. methodology you might divide the body of the article into three sections, each discussing one of

the methods. In these sections, be sure to describe the research methods and evaluate how studies were conducted focusing on the study design and analysis e.g. intention to treat versus completers / retention rate, compare studies, and discuss their implications.

Conclusions :- You should develop the conclusion by briefly restating the rationale for your review and the purpose of the article, then discussing the conclusions you have drawn. You should also discuss the implications of your review findings & where you think research in this field should go from here.

Literature cited :- Use a standardized referencing system. A widely used one in the medical literature is the AMA style.

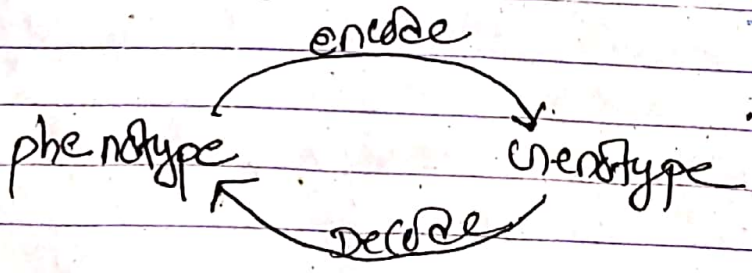
format

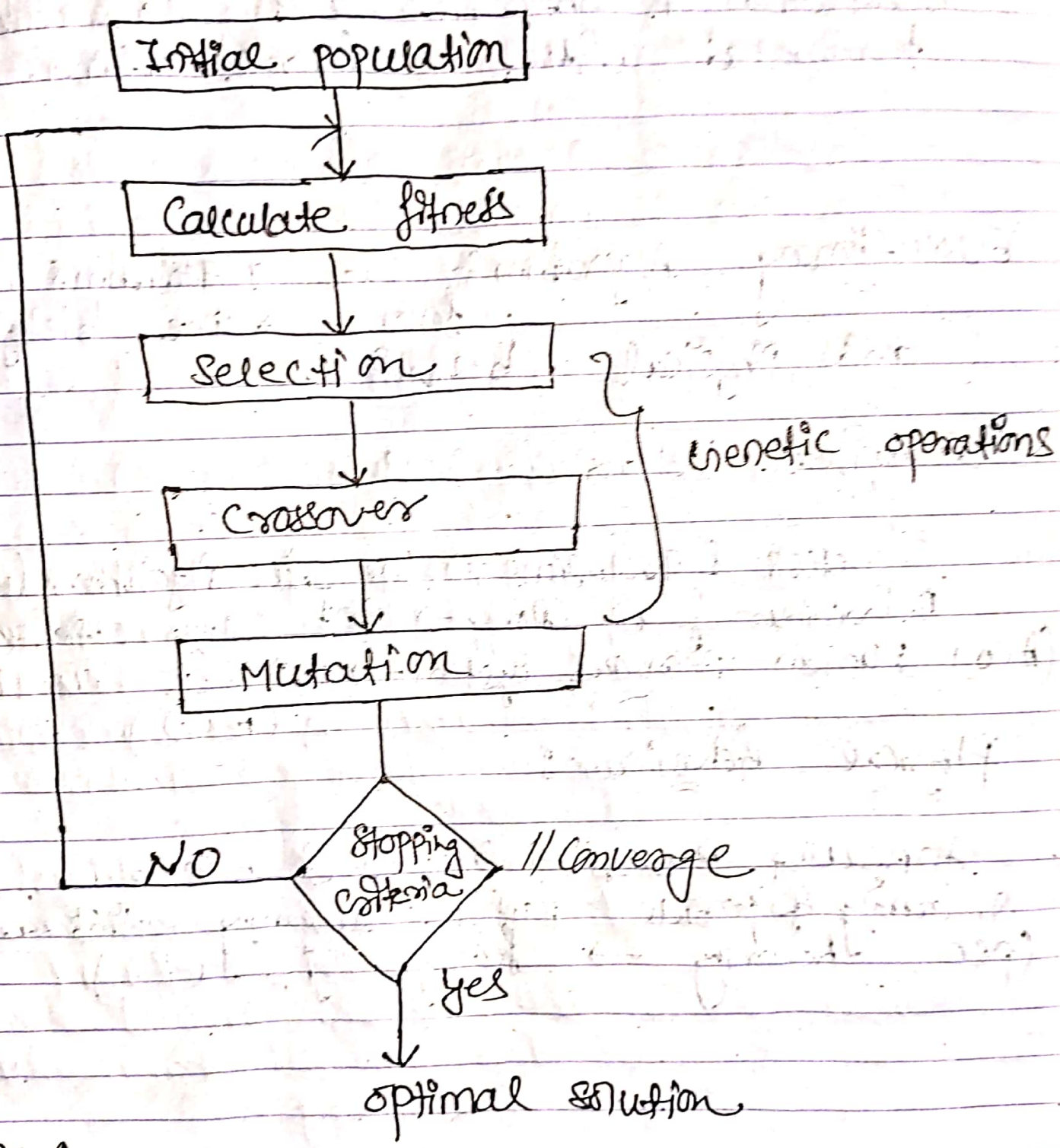
(I) Title page
(II) Abstract (200-300) words.
(III) Introduction → 1 or 2 paragraph
(IV) previous work
(V) Body
(VI) Comparision
(VII) Conclusion
(VIII) References

Genetic Algorithms (GAs)

→ John Holland

→ Abstraction of real biological evolution.
→ Solve complex problem (like NP Hard)
→ focus on optimization
→ population of possible solutions for a given problem.
⇒ from a group of individuals, the best will survive.
→





Note:
1) GA is an Heuristic process
2) It is a searching technique.
3) working cycle with/without convergence.

4) Solution is not necessarily guaranteed. Usually terminated with a local optima.

Evolutionary Algorithms :- The algorithms which follow some biological and physical behaviour.

- Biological Behaviour :-

Genetics & Evolutions → Genetic Algorithms (GAs)
Behaviour of ant Colony → Ant Colony optimization (ACO) Human nervous system → Artificial Neural network (ANN)

Physical Behaviour :-

Annealing process → Simulated Annealing (SA)
Swarming of particle → particle swarming optimization (PSO) Learning → fuzzy logic (FL)

Deep learning labs

EDA → Exploratory Data Analysis
- ↳ clean the data
- ↳ Remove Redudency
- ↳ Remove noise

Genetic Algorithm
- It is a subset of evolutionary algorithm.
  - Ant : Colony optimization
  - Swarm particle optimization

models biological process :
- Genetics
- Evolutions

USE It used because, to optimize highly complex objective function. Very diff. to model mathematically.

principles of GA based on two fundamental biological processes.

- Genetics: Gregor John mendel (1865)
- Evolution: Charls Darwin (1875)

Evolution: Natural selection
= =
four primary premises

(i) Information propegation: An offspring has many of his parent characteristics. [Heredity]

(ii) population diversity: variation in characteristics in the next generation [Diversity]

(iii) Survival for existence: only a small percentage of the offspring produced survive to adulthood [Selection]

(iv) Survival of the best: offspring survived depends on their inherited characteristics [Ranking]

Definition of GA or GAS is a population based probabilistic search and optimization techniques, which works based on the mechanism of natural genetics and natural evaluation.

optimization problem solving with GA

for the optimizing problem, identify the following.

(i) Objective functions
(ii) Constraints
(iii) Input parameters
(iv) Fitness evaluation
(v) encoding
(vi) decoding.

GA operators

A GA implementation involved in the realization of the following operations.

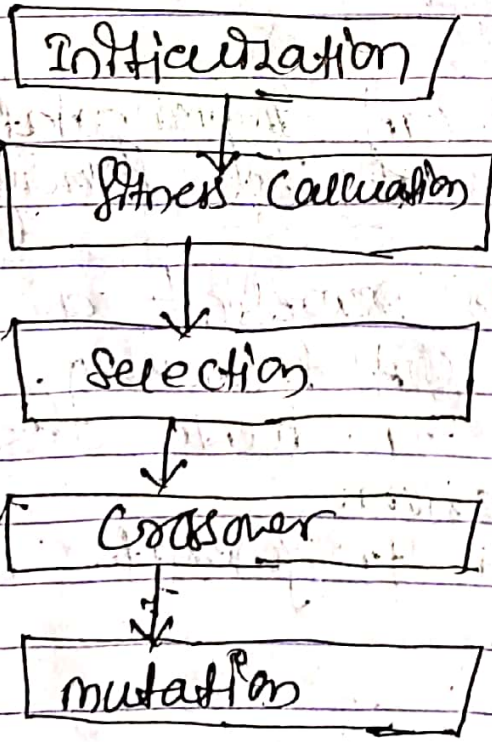
(i) Encoding: How to represent a solution to fit with GA framework.
(ii) Convergence: How to decide the termination criterion.
(iii) mating pool: How to generate next sets.

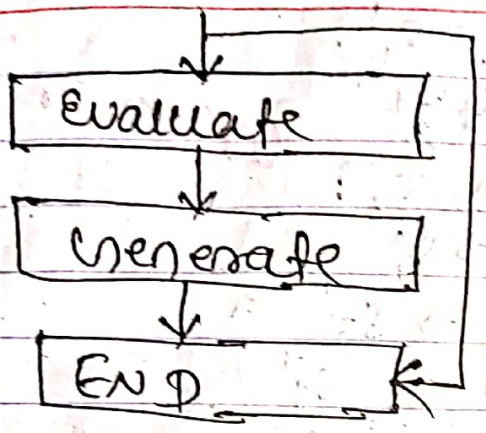
(iv) fitness evaluation: How to evaluate a sol's.
(v) crossover : How to make the diverse set of next solutions.
(vi) mutation : To explore other solutions.
(vii) Inversion : To move from one optima to other.

Diff. Genetic Algorithm strategies

(i) Simple Genetic Algo. (SGA)
(ii) Steady state GA (SSGA)
(iii) messy GA (mGA)

Genetic Algorithm





High level part

$l = 10$ $\quad n = 60$

$S_1 = 1111\,0\,1\,0\,1\,0 \Rightarrow f(S_1) = 7 = 20\%$

$S_2 = 0111\,0001\,01 \Rightarrow f(S_2) = 5 = 15\%$

$S_3 = 1110\,1\,1\,01\,0 \Rightarrow f(S_3) = 7 = 20\%$

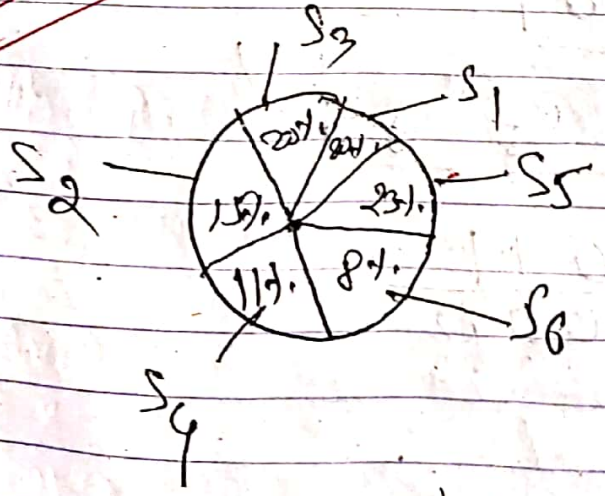
$S_4 = 0\,1\,0001\,0011 \Rightarrow f(S_4) = 4 = 11\%$

$S_5 = 1\,1\,1\,01\,1\,1\,1\,0\,1 \Rightarrow f(S_5) = 8 = 23\%$

$S_6 = 0\,1\,0011\,0000 \Rightarrow f(S_6) = 3 = 8\%$

34

Fitness Calculation



$\frac{34}{60} \times 100 = 57\%$

$S_1 = 1111\,0101\,0 \Rightarrow S_1'$

$S_3 = 11\,101\,101\,0 \Rightarrow S_2'$

$S_5 = 11\,101\,111\,0 \Rightarrow S_3'$

$S_2 = 011\,1\,0001\,0 \Rightarrow S_4'$

$S_4 = 01\,000\,100\,11 \Rightarrow S_5'$

$S_6 = 01\,001\,10000 \Rightarrow S_6'$

Crossover pairs

Crossover of S_1' & S_2'

$S_1' = 11\,|\,1\,0\,1\,0\,1\,0$

$S_2' = 11\,|\,1\,0\,1\,1\,0\,0$

$S_1'' = 11\,101\,101\,0$

$S_2'' = 11\,111\,010\,1$

Crossover of S_5' & S_6'

$S_5' = 01000\,|\,10011$

$S_6' = 01001\,|\,10000$

$S_6'' = 01000\,100000$

$S_6'' = 01001\,10011$

$S_3'' = 1110|1110|$

$S_4'' = 0111|0001|0|$

now;

$S_1'' = 1110|1\underline{0}10|$

$S_2'' = 1110|1010|$

$S_3'' = 1110\underline{1}|1\underline{0}|$

$S_4'' = 0111\underline{0}001|0|$

$S_5'' = 0100|0100|0$

$S_6'' = 0100|10\underline{0}|1|$

After mutation,

$S_1''' = 1110|1110|1|0| \Rightarrow f(S_1''') = 8$

$S_2''' = 1110|1010| \Rightarrow f(S_2''') = 7$

$S_3''' = 1100|1111| \Rightarrow f(S_3''') = 8$

$S_4''' = 0111|0010| \Rightarrow f(S_4''') = 6$

$S_5^{III} = 01000\,1110\,1 = f(S_5^{III}) = 5$

$S_6^{III} = 1110\,1101\,11 = f(S_6^{III}) = 8$

13%

42

$\frac{42}{60} \times 100\%$

$= 70\%$

total change $= |70\% - 57\%|$

$= 13\%$

Selection rules :- It choose individuals (parent) that contribute to the population of the next generations.

Crossover rules :- It joints two parents to generate a child for next generations.

mutation rules :- It applies changes to individual parent to create children (offspring)

GA operator

following are the GA operators in GAs.

- ↳ encoding
- ↳ fitness evaluation
- ↳ crossover
- ↳ mutation

Genetic Algorithm

Adaptive heuristic search Algo.

Evolutionary Alg o.

Genetics & natural selection

Population & Individual

To generate high-quality solution for optimization problem

Convergence Test / Termination condition

(i) manual checking
(ii) solution found that satisfy objective criteria
(iii) fixed number of generation.
(iv) budget limit reached.

Encoding

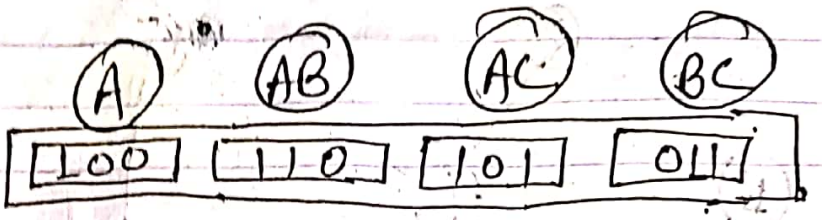
Binary Encoding :-

(A) = 5 (100)

(B) = 10 (150)

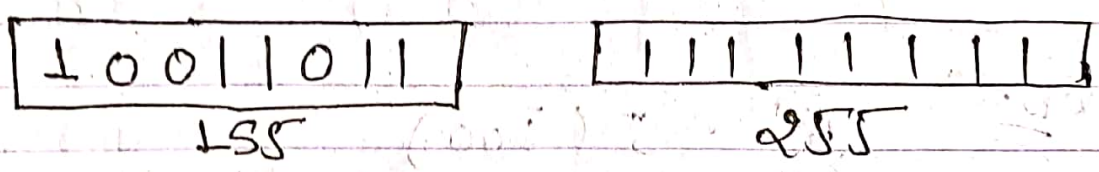
(C) = 15 (200)

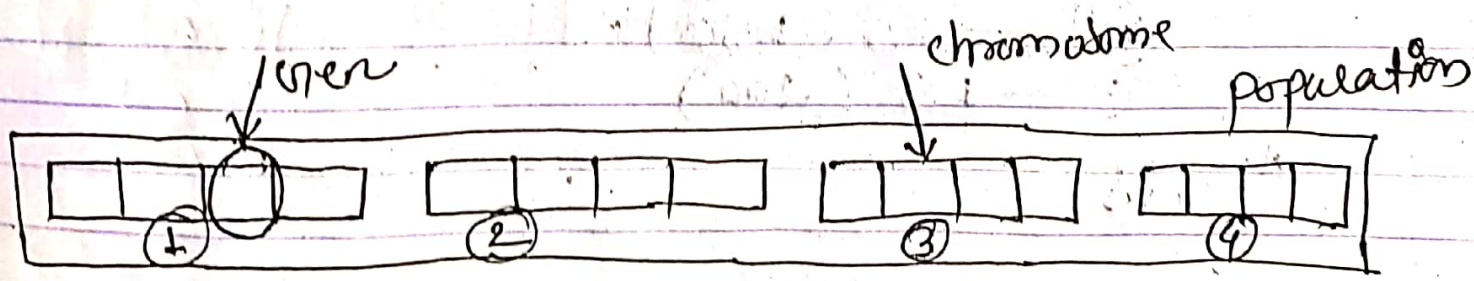
M = 25



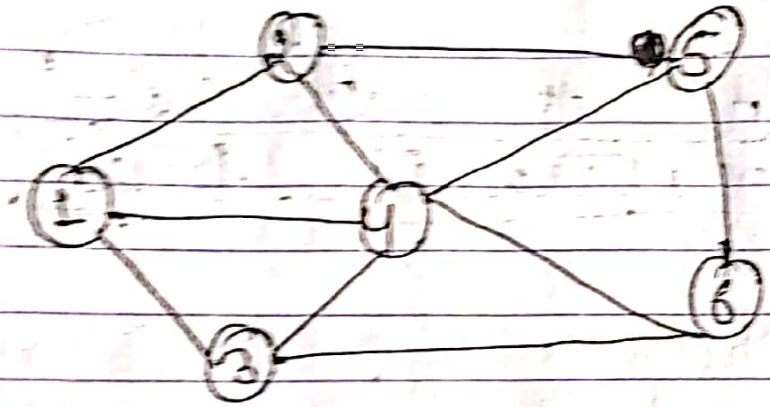
example : $f(x) = x^3$; $0 \le x \le 255$

→ 8-bit digit





Fitness evaluation : Fitness function
or
objective function



path 1 : 1 2 5 6 4 3 1 — (18)
path 2 : 1 2 5 4 6 3 1 — (20)
path 3 : 1 2 4 5 6 3 1 — (12) ✓ optimal soln
path 4 : 1 2 5 6 3 4 1 — (17)

Ex 2:

(A) - 5 (100)
(B) - 10 (150)
C - 15 (200)

M = 25

Possible Sol^n

	A B C	Weight	Profit
(A) →	1 0 0	5	100
(AB) →	1 1 0	15	250
(AC) →	1 0 1	20	300
(BC) →	0 1 1	25	350 max.
(ABC) →	1 1 1	~~30~~	450

X

Crossover

P1 : 0 1 | 1 1 0 | 1 0

P2 : 1 1 | 0 1 0 | 0 0

K_3 K_1 K_2

Single point crossover only K_1.

O_1 : 0 1 0 1 0 0

O_2 : 1 1 1 0 1 0

} new offspring

two point crossover K_1 & K_2.

O_1 : 0 1 0 1 1 0

O_2 : 1 1 1 0 0 0

multi point crossover (Alternative swap)

O_1 : 1 1 0 1 1 0

O_2 : 0 1 1 0 0 0

uniform crossover

P1 : 0 0 1 0 1 1

P2 : 1 0 0 1 0 0

Tosing : 1 0 0 1 1 0

In toss.
1 → change
0 → no change.

O_1 : 1 0 1 1 0 1

O_2 : 0 0 0 0 1 0

Cross over mask (CM): → Randomly generated.

CM: | 0 | 1 | 0 | 1 | 1 | 0 |

for O_1, 0 → P1
1 → P2

O_1 : 0 0 1 1 0 1

O_2 : 1 0 0 1 1 0

for O_2, 0 → P2
1 → P1

Mutation

= bit flipping technique

offspring: 0 1 1 0 0 1

mutation probability (mp),

MP (mp): 0 1 0 0 0 1

modified offspring: 0 0 1 0 0 0

Interchanging

0 : 0 1 1 0 0 1

M 0 : 0 0 1 0 1 1

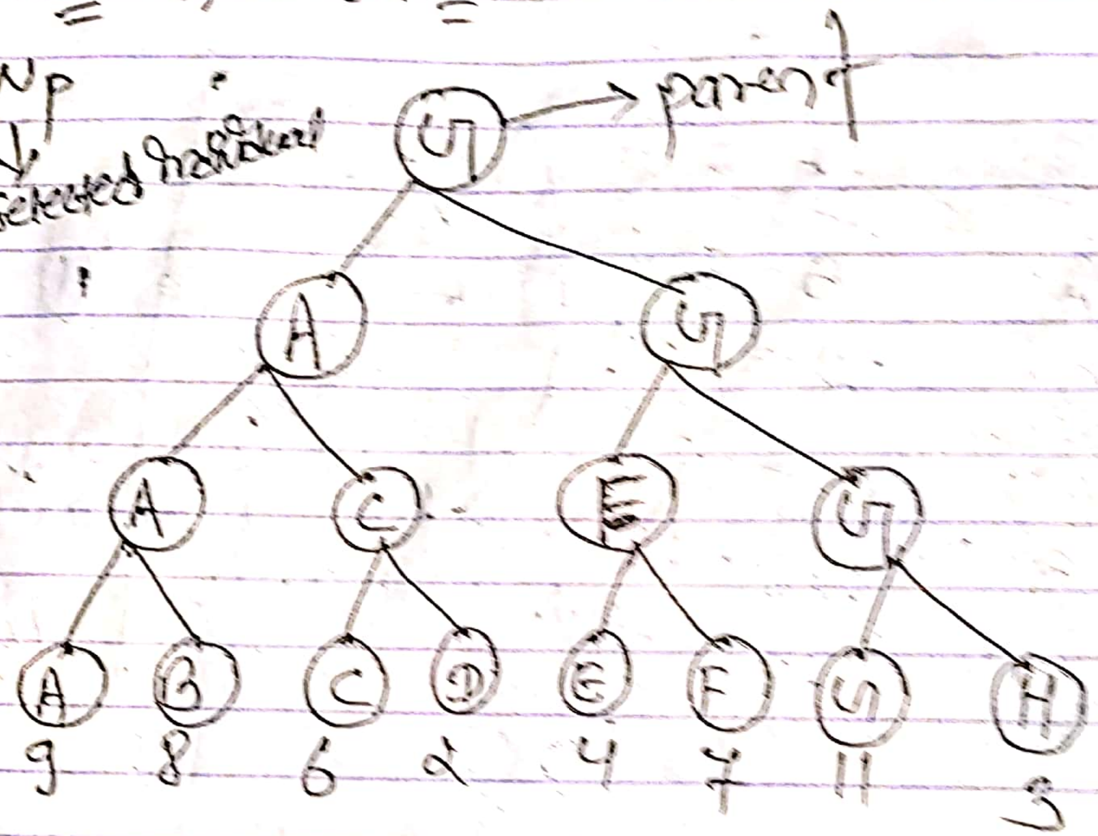
Selection

① Tournament Selection

N ⟹ Np

N ↓ initial population

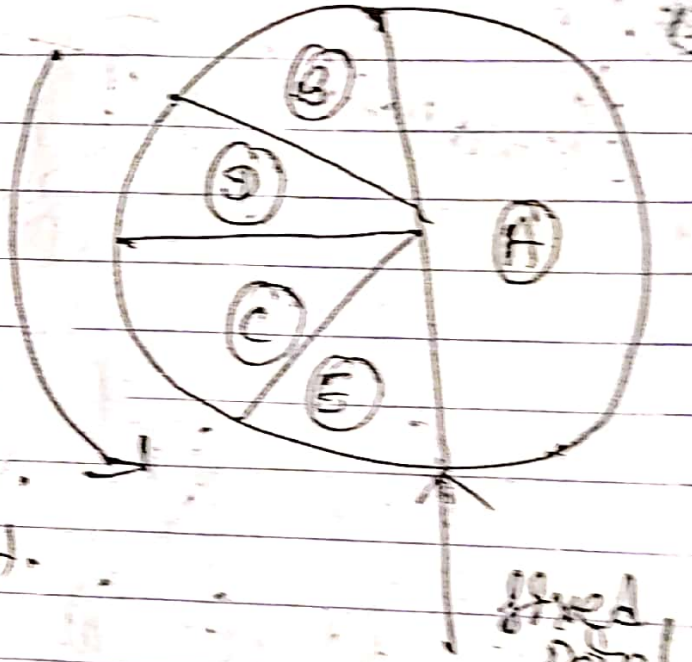
Np ↓ selected individual



(ii) Roulette wheel selection

Selection of fitness score.

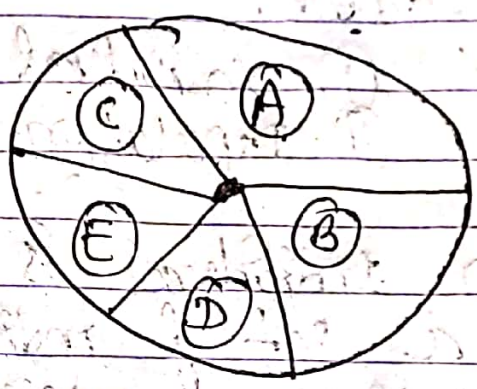
C	F
A	5 = 50%
B	2 = 20%
C	0.5 = 5%
D	1.5 = 15%
E	1 = 10%
	10



Fitness of Area occupied of selection

(iii) Ranked based selection

C	F	Rank
(A)	5	5 = 33.33%
(B)	2	4 = 26.67%
(C)	0.5	1 = 6.67%
(D)	1.5	3 = 20%
(E)	1	2 = 13.33%
		15



Encoding Scheme

Binary encoding → Binary coded GA or simply Binary GA.

Real value Encoding → Real coded GA or simply Real GA.

order encoding → order GA (also called as permuted GA) Tree encoding.

GAs uses metaphor consisting of two distinct elements.

(I) Individual
(II) Population.

An Individual is a single soln while a population is a set of Individuals at an instant of searching process.

An Individual is defined by a chromosome. A chromosome store genetic information (called Phenotype) for an individual.

Encoding techniques

(I) Binary encoding: Representing a gene in terms of bits (0's & 1's)

(II) Real value encoding: Representing a gene in terms of value or symbol or string.

(III) permutation (or order) encoding: Representing a sequence of elements.

(IV) Tree encoding: Representing in the form of a tree of objects.

Pros of Binary encoding :-

(I) Since, operations with binary representation is faster it provide a faster implementations of all GA operations & hence the execution of GAs.

(II) Any optimization problem has it binary-coded GA implementation.

Cons of Binary encoding

(I) Needs an effort to convert into binary form.
(II) Accuracy depends on the binary representation.

Real Value encoding

Eg :- $1 \le x \le 16$, $n=6$ what is the accuracy?

$$\varepsilon = \frac{16-1}{2^6} = \frac{15}{64} = 0.249 \simeq 0.25$$

Eg 2:- What is the obtainable all - for the binary representation for a variable x in the range $20.1 \le x \le 45.6$ with 8-bits?

Sol:-

$$20.1 \le x \le 45.6$$

$$n = 8$$

$$\varepsilon = \frac{45.6 - 20.1}{2^8} = \frac{25.5}{256} = 0.099$$