global search
↑ heuristics

Genetic Algo (John holland) (Search technique used for finding true or exact solutions)

- Usually starts from randomly generated population
- In each generation, fitness of every individual is calculated, multiple individuals selected, modified to form new population.
- Terminates when → • Either max no of generations has been produced ✓
  • Good fitness level has been reached. ✓
- Techniques → • Parental Selection
  • Crossover
  • Mutation
- General Steps → • Select encoding type
  • Select population size
  • Randomly choose initial population
  • Select Parental Chromosomes
  • Crossover & Mutation
  • Evaluate off spring
  • Stop criteria, if not met go to step 4.

Initialization
↓
Selection
↓
Crossover
↓
Mutation
↓
Evaluate
↓
Generate

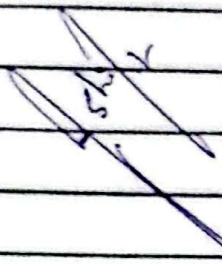
- Evalution starts → with randomly generated individuals → select fittest by seeing fitness

↓

alter or mutate the selected fittest for new generation

•— Genetic Algo — Encoding
- Binary encoding (common)
- Value-Based encoding
- Permutation encoding.

•— Selection → • first operator applied on encoded population.
↓ based on fitness function
• Chromosomes selected as parents + crossover + produce offsprings.
• Common Chromosome selection method ⇒ Roulette wheel ✓
Boltzmann ✓
Tournment ✓
Rank ✓
Steady State.



•— Crossover → 2 options → • Chromosomes of 2 parents are copied to next generation.
• 2 parents are randomly recombined to form new child
↓ do bcz new chromosomes maybe better.
Types → • Single Point • uniform crossover.
• Two point
↓
• random subset is chosen

•— Mutation → • purpose → maintain diversity (new & different solutions) • Lost information ko population main la kr atta hy.
• Alter one or more genes values in Chromosomes so new chromosomes added to pool.

Example :-

- Maximize function $f(x) = x^2$, x ranges from 0 - 31

(1) • Choose encoding technique

0 → 00000

31 → 11111

(2) • Choose population size

n = 4

(3) • Randomly Choose initial population

13, 24, 8, 19

(4) • Select parental chromosomes.

Roulette Wheel Selection method.

String No	Initial Population	X value	F(x)	Probability count	Expected count	Actual count
1	01101	13	169	0.14	0.58	1
2	11000	24	576	0.49	1.97	2
3	01000	8	64	0.06	0.22	0
4	10011	19	361	0.31	1.23	1
	↓ Binary of X		1170	F(x)/1170	4 F(x)/Avg	Round off expected

Avg = 1170/4 = 293

(5) Crossover

String 2	11 000	11 001
String 1	01 101	01 100

String 2	11	000	11011
String 4	10	011	10000

(6)

String No	offspring	X value	F(x) Value
1	01100	12	144
2	11001	25	625
3	11011	27	729
4	10000	16	100