Sample Problem

Genetic Algorithm

SAMPLE PROBLEM

- **Maximize $f(x) = x^2$; where x is permitted to vary between 0 and 31**

1. Coding of decision variables as some finite length string

X as binary unsigned integer of length 5

[0, 31] = [00000, 11111]

2. Constant settings

Pmutation=0.0333

Pcross=0.6

Population Size=30

DeJong(1975) suggests high crossover Probability, low mutation probability (inversely proportional to the pop.size), and A moderate population size

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3. **Select initial population at random** (use even numbered population size)

String number	Initial Population	X value	f(x)	pselect $\frac{f_i}{\sum f}$	Expected count $\frac{f_i}{\bar{f}}$	Actual count(Roulette Wheel)
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

Sum	1170
Ave.	293
Max.	576

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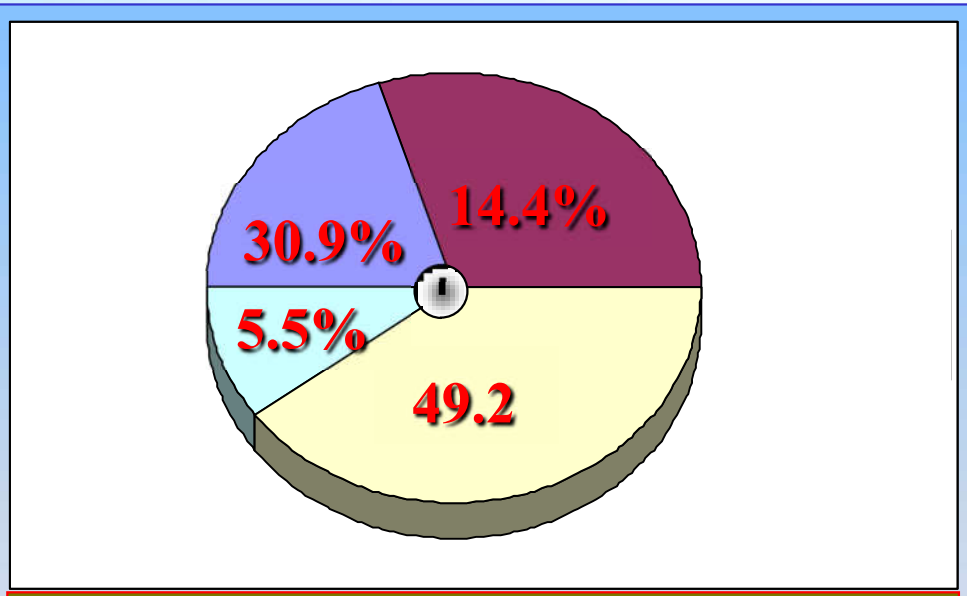
4. **Reproduction:** select mating pool by spinning roulette wheel 4 times.



Weighted Roulette wheel

	pselect
01101	0.14
11000	0.49
01000	0.06
10011	0.31

The best get more copies.
The average stay even.
The worst die off.

Choosing offspring for the next generation

```
int Select(int Popsize, double Sumfitness, Population Pop){
    partSum = 0

    rand=Random * Sumfitness
    j=0
    Repeat
        j++;
        partSum = partSum + Pop[j].fitness
    Until (partSum >= rand) or (j = Popsize)

    Return j
}
```

[0,1]

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5. Crossover – strings are mated randomly using coin tosses to pair the couples

- mated string couples crossover using coin tosses to select the crossing site

String number	Mating Pool after Reproduction	Mate (randomly selected)	Crossover site (random)	New population	X-value	$f(x)=x^2$
1	0110|1	2	4	01100	12	144
2	1100|0	1	4	11001	25	625
3	11|000	4	2	11011	27	729
4	10|011	3	2	10000	16	256

Sum	1754
Ave.	439
Max.	729