

task1

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Question 1: Genetic algorithm

1.

Function

$$f(x) = \frac{x^2}{e^x} - 2\exp(-(9\sin x)/(x^2 + x + 1))$$

```
f <- function(x){  
  part1 <- (x^2) / exp(x)  
  expPart <- -(9*sin(x)) / ((x^2) + x + 1)  
  return(part1 -2 * exp(expPart))  
}
```

2.

Crossover function $\frac{x+y}{2}$:

```
crossover <- function(x,y){  
  return((x+y)/2)  
}
```

3.

mutate function $x^2 \bmod 30$:

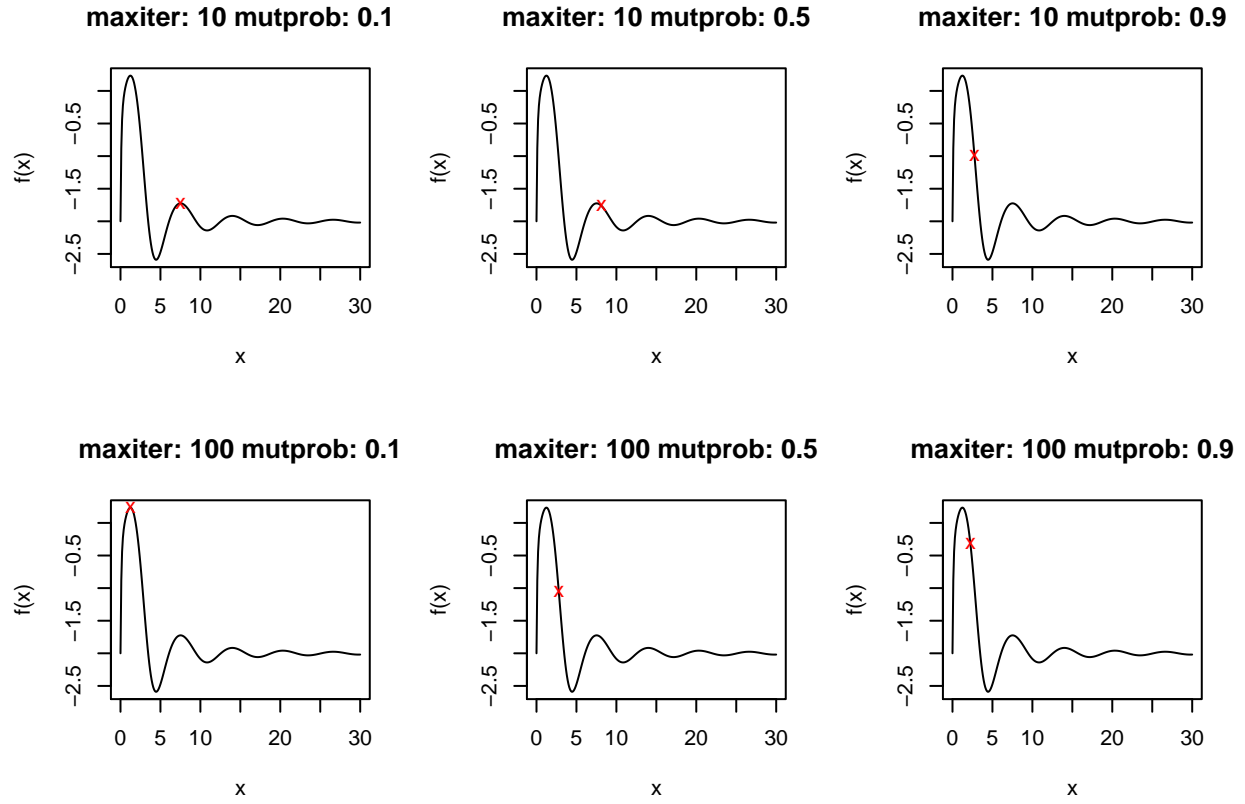
```
mutate <- function(x){  
  return((x^2)%% 30)  
}
```

4.

Function implementing genetic algorithm:

1. initialize parameters
2. select parents
3. select victim
4. generate kid by crossover and mutation
5. replace victim with kid
6. save best value
7. repeat steps 2 to 3 maxiterations times.

5.



initial	0.000000	5.000000	10.000000	15.000000	20.000000	25.000000	30.000000
10 0.1	0.000000	7.500000	7.500000	15.000000	20.000000	25.000000	11.250000
10 0.5	0.000000	6.250000	21.395569	15.000000	20.000000	22.265625	8.125000
10 0.9	18.754927	6.250000	2.748795	15.000000	20.000000	9.376913	13.125000
100 0.1	1.260766	1.278022	1.255835	1.253370	1.243509	1.236114	1.250905
100 0.5	2.821947	2.791309	2.828550	2.816665	2.825117	2.813760	7.982031
100 0.9	2.268283	2.242559	5.086924	2.261852	2.294006	2.281144	2.242559

10 iterations are not enough for genetic algorithm to find the max value. It can be seen that increasing mutation propability, max value will fluctuate around the max value and will not reach it.