Computational Statistics

Lab 6

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Question 1

1.1

```
genfunc <- function(x) {
    (x^2 / exp(x)) - 2 * exp(-(9 * sin(x)) / (x^2 + x + 1))
}
```

1.2

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

1.3

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

1.4

```
genetic <- function(maxiter, mutprob) {
    ## a)
    ## plot(x = 0:30, y= genfunc(0:30),  xlim = c(0,30), type ="l", xlab="", ylab="")

    ## b)
    X <- seq(0,30,by = 5)

    ## c)
    values <- genfunc(X)
    ## points(X, values, col = "red")

    ## d)
    bestvalue <- -Inf

    for (i in 1:maxiter){

        ## i
```

```
        parents <- sample(1:length(X), size = 2 )

        ## ii
        victim <- which.min(values)

        ## iii
        child <- crossover(X[parents[1]],X[parents[2]])

        if (mutprob > runif(1,0,1)) {
            child <- mutate(child)
        }

        ## iv
        X[victim] <- child

        values[victim]<- genfunc(child)
        ## values <- genfunc(X)

        ## v
        bestvalue <- max(bestvalue, max(values))
    }

    ## points(x = X, y = values, col = "darkgreen")
    list(opt=bestvalue, pop=X, vals=values)
}
```

1.5

```
func_data <- data.frame(x=seq(0, 30, by=0.1), y=genfunc(seq(0, 30, by=0.1)))

set.seed(123456)
r1 <- genetic(maxiter = 10, mutprob = 0.1)
r1$opt
```

```
## [1] -1.7
```

```
set.seed(123456)
r2 <- genetic(maxiter = 10, mutprob = 0.5)
r2$opt
```

```
## [1] 0.14
```

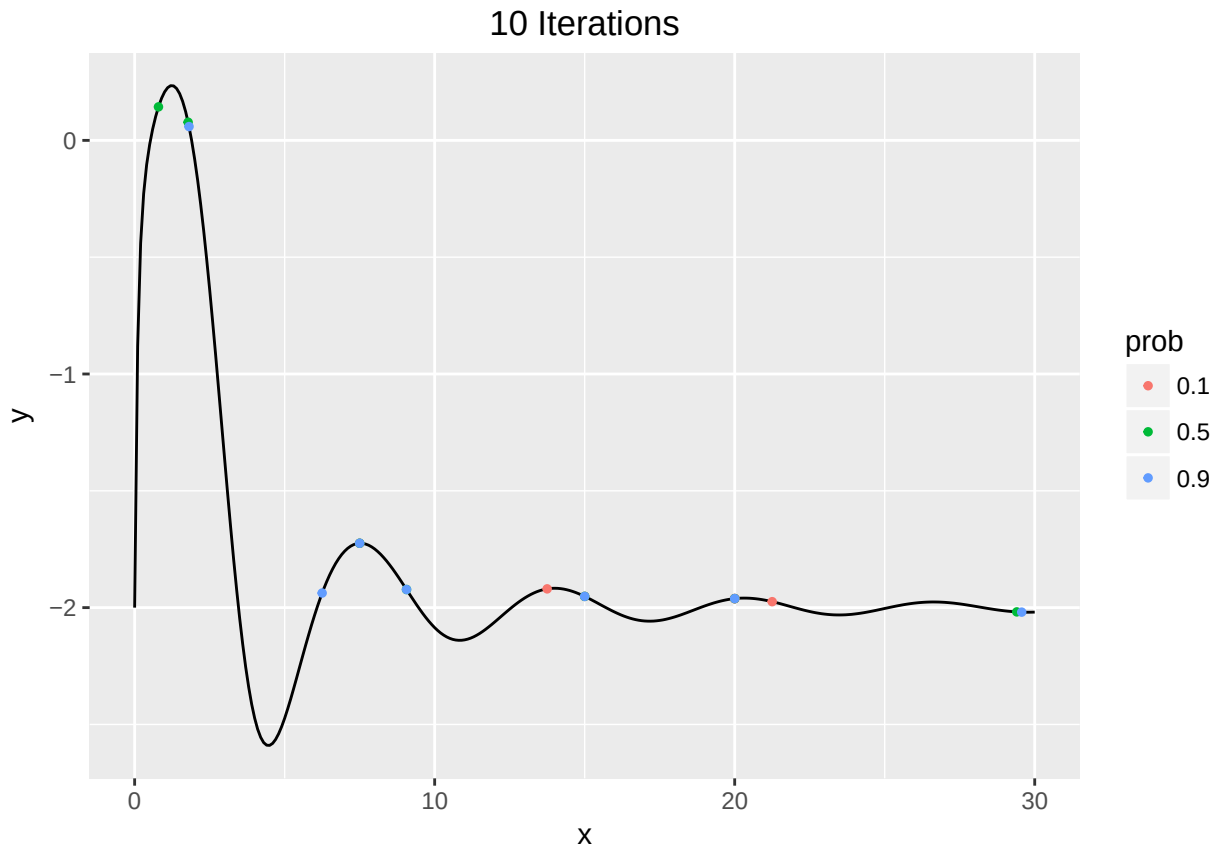
```
set.seed(123456)
r3 <- genetic(maxiter = 10, mutprob = 0.9)
r3$opt
```

```
## [1] 0.059
```

```
rd1 <- data.frame(x=r1$pop, y=r1$vals, prob="0.1")
rd2 <- data.frame(x=r2$pop, y=r2$vals, prob="0.5")
rd3 <- data.frame(x=r3$pop, y=r3$vals, prob="0.9")

plot_data <- rbind(rd1, rd2, rd3)
```

```
ggplot() +
    ggtitle("10 Iterations") +
    geom_line(data=func_data, aes(x=x, y=y)) +
    geom_point(data=plot_data, aes(x=x, y=y, col=prob), size=1) +
    theme(plot.title=element_text(hjust=0.5))
```




```
set.seed(123456)
r1 <- genetic(maxiter = 100, mutprob = 0.1)
r1$opt
```

```
## [1] -1.7
```

```
set.seed(123456)
r2 <- genetic(maxiter = 100, mutprob = 0.5)
r2$opt
```

```
## [1] 0.23
```

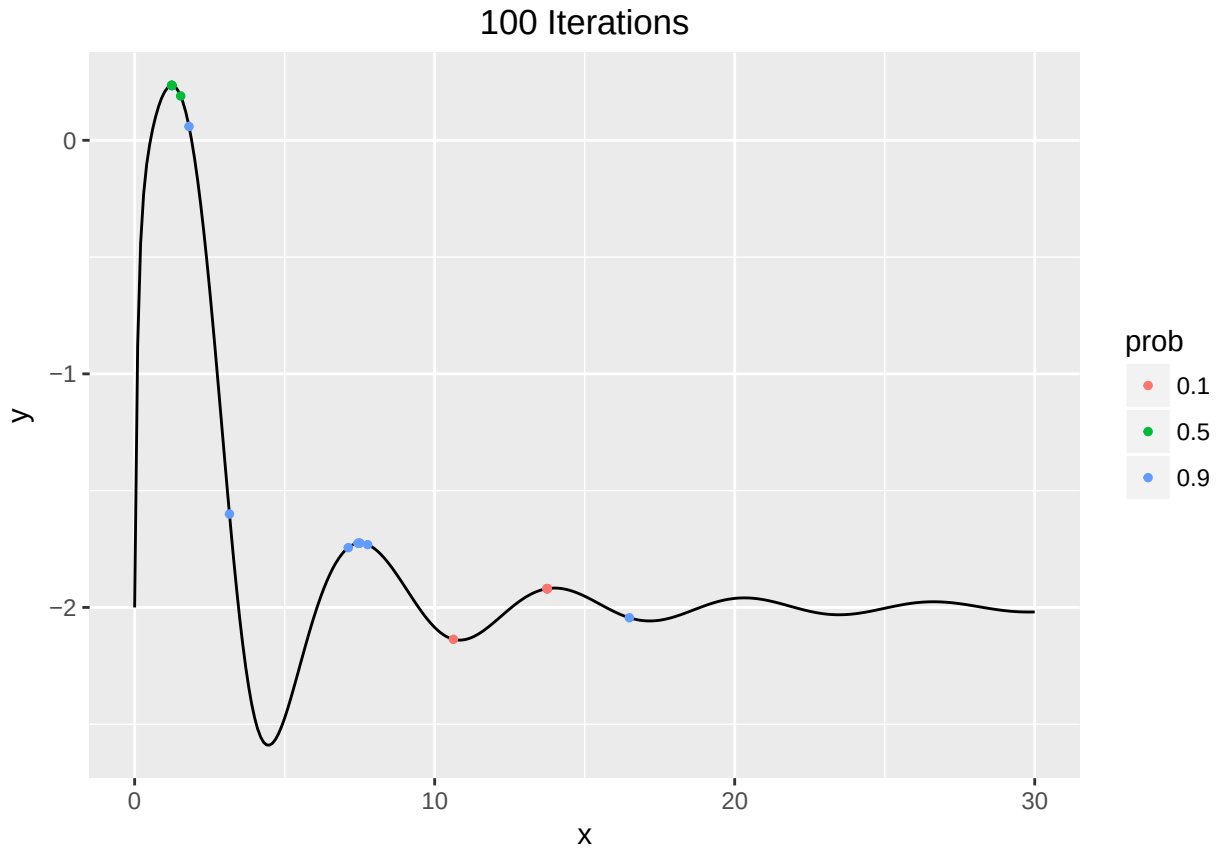
```
set.seed(123456)
r3 <- genetic(maxiter = 100, mutprob = 0.9)
r3$opt
```

```
## [1] 0.059
```

```
rd1 <- data.frame(x=r1$pop, y=r1$vals, prob="0.1")
rd2 <- data.frame(x=r2$pop, y=r2$vals, prob="0.5")
rd3 <- data.frame(x=r3$pop, y=r3$vals, prob="0.9")
```

```r
plot_data <- rbind(rd1, rd2, rd3)

ggplot() +
    ggtitle("100 Iterations") +
    geom_line(data=func_data, aes(x=x, y=y)) +
    geom_point(data=plot_data, aes(x=x, y=y, col=prob), size=1) +
    theme(plot.title=element_text(hjust=0.5))
```



Question 2

2.1

2.2

2.3

2.4