HW3

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Question 1

```
rosen <- function(var) {
  res <- (1 - var[1])^2 + 100 *((var[2] - (var[1]^2))^2)
  res
}

test <- c(6,8)

rosen(test)
```

```
## [1] 78425
```

```
niter <- 100000
x <- matrix(NA,ncol=2,nrow=niter)
x[1,] <- c(2,2)


temp <- 5000
sigma <- 1
i <- 1

for (i in 1:(niter-1)) {
  xnew <- x[i,] + rnorm(2,0,sigma)
  if(rosen(xnew) < rosen(x[i,])){
    x[i+1,] <- xnew
  } else {
    p <- exp(-(rosen(xnew) - rosen(x[i,])) / temp)
    if (runif(1) < p) {
      x[i+1,] <- xnew
    } else {
      x[i+1,] <- x[i,]
    }
  }
  temp <- 0.999*temp
}

x[100000,]
```

```
## [1] 1.009113 1.017560
```

Looking like (1,1) is the minimum

Question 2

```r
xgrad <- function(x){
  (2*(x[1]-1) - (400*x[1]*(x[2] - (x[1]^2))))
}

xgrad(c(1,1.4))
```

```
## [1] -160
```

```r
ygrad <- function(x){
  200*(x[2] - x[1]^2)
}

ygrad(c(2.6,1.4))
```

```
## [1] -1072
```

```r
gamma <- 0.005
z <- c()

z[[1]] <- c(0,6)

for (i in 1:1000){
  z[[i+1]] <- c(NA,NA)
  z[[i+1]][1] <- z[[i]][1] - (gamma * xgrad(z[[i]]))
  z[[i+1]][2] <- z[[i]][2] - (gamma * ygrad(c(z[[i+1]][1],z[[i]][[2]])))
}

do.call(rbind,z)[1001,]
```

```
## [1] 0.9999568 0.9999137
```

Right back at (1,1)

Question 3

```r
simp <- function(a,b,f,n){
  if (n %% 2 != 0) {
    stop("You suck bozo")
  }
  h <- (b - a) / n
  x <- seq(a,b, by = h)
  y <- f(x)
```

```r
  area <- (h/3) * (y[1] + y[n+1] +
                     4 * sum(y[seq(2,n,by=2)]) +
                     2 * sum(y[seq(3,n-1,by=2)]))


  return(area)
}

q3 <- function(x){
  (sin(x)+1) * (cos(x)+1)
}

simp(0,3*pi,q3,1000)
```

```
## [1] 11.42478
```

Area = 11.425

```r
3*pi + 2
```

```
## [1] 11.42478
```

^ Actual area

Question 4

```r
set.seed(740)
nsim <- 1000000

f <- function(var){
  dexp(var,1/10)
}

ux <- runif(nsim,0,10)
uy <- runif(nsim,0,0.1)

mean(f(ux) > uy)
```

```
## [1] 0.631671
```

$P(0 < X < 10) \approx 0.632$

```r
1 - exp(-1)
```

```
## [1] 0.6321206
```

^ Actual probability

Question 5

```r
set.seed(614)
nsim <- 1000000
samp <- rgamma(nsim,5,5)
fifth_moment <- samp^5
mean(fifth_moment)
```

```
## [1] 4.814195
```

$E(X^5) \approx 4.81$

```r
(1/5^5 * gamma(10)) / gamma(5)
```

```
## [1] 4.8384
```

```r
(5 * 6 * 7 * 8 * 9) / 5^5
```

```
## [1] 4.8384
```

^ Actual 5th moment