Lab 1: solutions

August 25, 2009

Exercise 2.1 :

1.
```
> 2^7/(2^7 - 1)

[1] 1.007874

> (1 - 1/2^7)^-1

[1] 1.007874
```

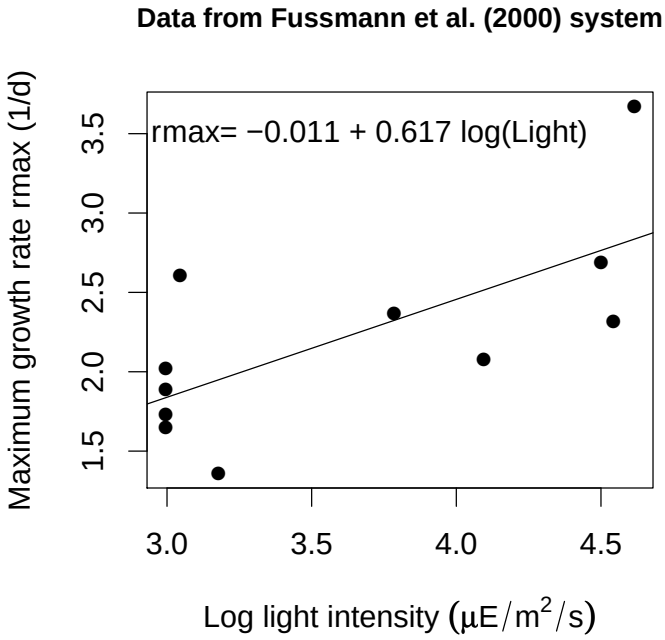
2.
```
> 1 + 0.2

[1] 1.2

> 1 + 0.2 + 0.2^2/2

[1] 1.22

> 1 + 0.2 + 0.2^2/2 + 0.2^3/6

[1] 1.221333

> exp(0.2)

[1] 1.221403
```

3.
```
> x = 1
> 1/sqrt(2 * pi) * exp(-x^2/2)

[1] 0.2419707

> dnorm(1)

[1] 0.2419707

> x = 2
> 1/sqrt(2 * pi) * exp(-x^2/2)
```

```
[1] 0.05399097

> dnorm(2)

[1] 0.05399097
```

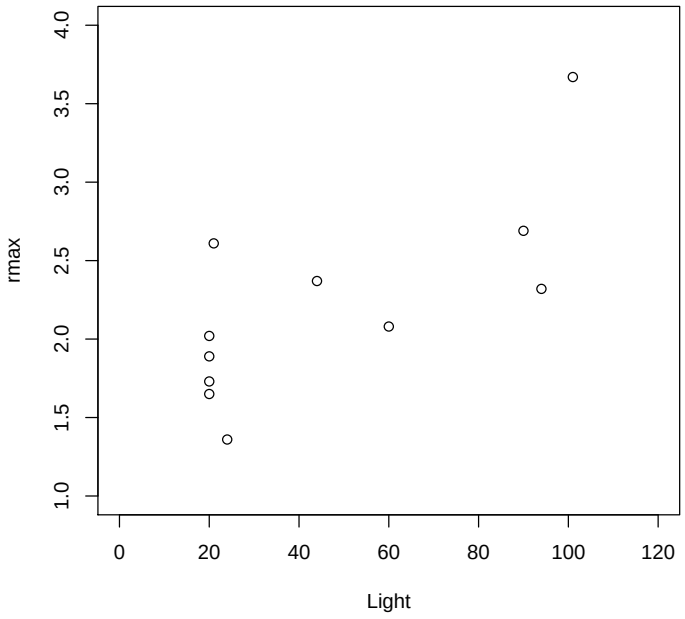
Exercise 3.1 : (nothing to write down!)
Exercise 5.1 :

```
> X = read.table("ChlorellaGrowth.txt", header = TRUE)
> Light = X[, 1]
> rmax = X[, 2]
> logLight = log(Light)

> op <- par(cex = 1.5, cex.main = 0.9)
> plot(logLight, rmax, xlab = expression(paste("Log light intensity ",
+     (mu * E/m^2/s))), ylab = "Maximum growth rate rmax (1/d)",
+     pch = 16)
> title(main = "Data from Fussmann et al. (2000) system")
> fit = lm(rmax ~ logLight)
> abline(fit)
> rcoef = round(coef(fit), digits = 3)
> text(3.7, 3.5, paste("rmax=", rcoef[1], "+", rcoef[2], "log(Light)"))
> par(op)
```



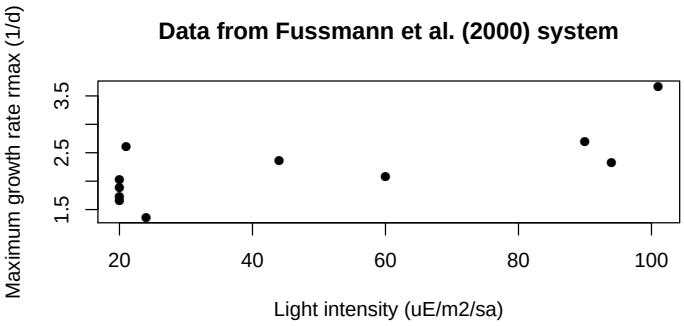
Exercise 5.2 : explained in text
Exercise 5.3 :

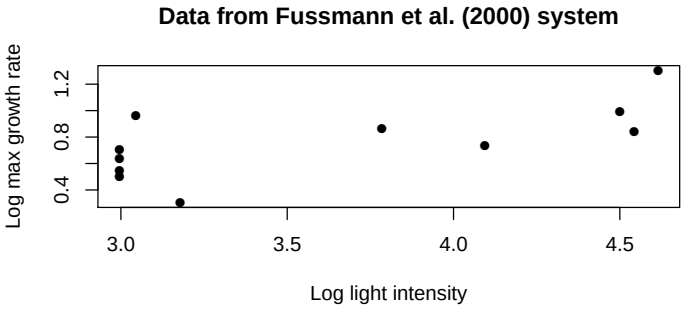
```
> plot(Light, rmax, xlim = c(0, 120), ylim = c(1, 4))
```



Exercise 5.4 :

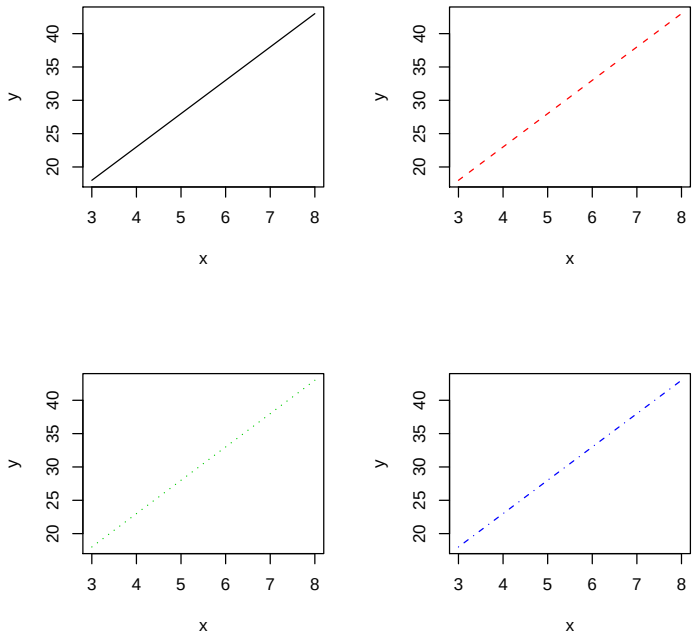
```
> X = read.table("ChlorellaGrowth.txt", header = TRUE)
> Light = X[, 1]
> rmax = X[, 2]
> logLight = log(Light)
> logrmax = log(rmax)

> op <- par(mfcol = c(2, 1))
> plot(Light, rmax, xlab = "Light intensity (uE/m2/sa)", ylab = "Maximum growth rate rmax (1
+     pch = 16)
> title(main = "Data from Fussmann et al. (2000) system")
> plot(logLight, logrmax, xlab = "Log light intensity", ylab = "Log max growth rate",
+     pch = 16)
> title(main = "Data from Fussmann et al. (2000) system")
> par(op)
```





Exercise 5.5 :

```
> x = 3:8
> y = 5 * x + 3

> op = par(mfrow = c(2, 2))
> plot(x, y, lty = 1, col = 1, type = "l")
> plot(x, y, lty = 2, col = 2, type = "l")
> plot(x, y, lty = 3, col = 3, type = "l")
> plot(x, y, lty = 4, col = 4, type = "l")
> par(op)
```



Exercise 5.6 : (nothing to say)
Exercise 8.1 :

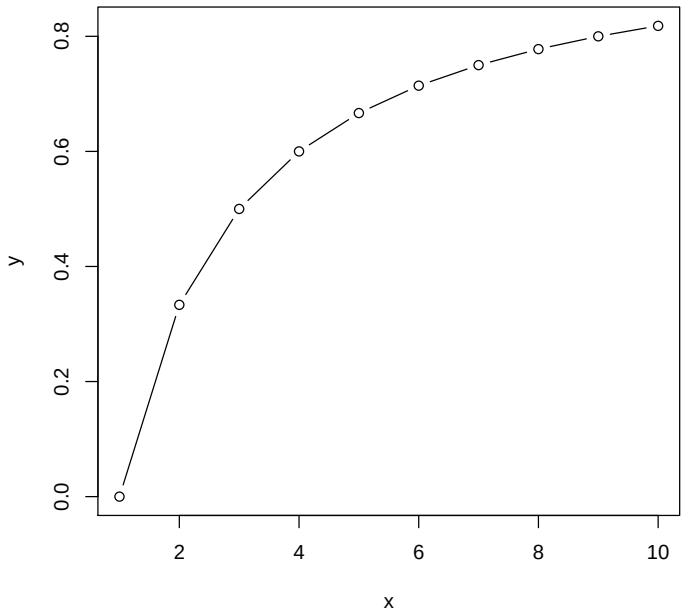
```
> seq(1,13,by=4)

[1]  1  5  9 13

> ## or
> seq(1,by=4,length=4)

[1]  1  5  9 13

> seq(1,5,by=0.2)

 [1] 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8 4.0 4.2 4.4 4.6
[20] 4.8 5.0
```

Exercise 8.2 :

```
> z=c(1,3,5,7,9,11) ## set value of z
> z[c(2,1,3)]

[1] 3 1 5
```

Exercise 8.3 :

```
> x = 1:10
> y = (x - 1)/(x + 1)

> plot(x, y, type = "b")
```



Exercise 8.4:

```
> r = 0.5
> n = 10
> G = r^(0:n)
> sum(G)

[1] 1.999023

> 1/(1 - r)

[1] 2

> n = 50
> sum(r^(0:n))

[1] 2

> 2 - sum(r^(0:n))
```

```
[1] 8.881784e-16
```

Exercise 8.5 :

```
> x = runif(20)
> x[x < mean(x)]

 [1] 0.37069666 0.30112554 0.28182822 0.52556405 0.50457236 0.06513760
 [7] 0.05404782 0.15732081 0.04907215 0.24347885
```

Exercise 8.6 :

```
> which(x < mean(x))

 [1]  3  5  6  7  9 10 11 15 17 20
```

or

```
> p = 1:length(x)
> p[x < mean(x)]

 [1]  3  5  6  7  9 10 11 15 17 20
```

Exercise 8.7 *:

```
> x = 1:40
> n = length(x)
> x[seq(1, n, by = 2)]

 [1]  1  3  5  7  9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39

> x[-seq(2, n, by = 2)]

 [1]  1  3  5  7  9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39
```

Exercise 9.1 *:

```
> v = c(1, 2, 1, 2, 1, 2, 1, 2)
> X = matrix(v, nrow = 2, ncol = 4)
```

or

```
> v = rep(1:2, 4)
> X = matrix(v, nrow = 2, ncol = 4)
```

or

```
> v = rep(1:2, each = 4)
> X = matrix(v, nrow = 2, ncol = 4, byrow = TRUE)
```

Exercise 9.2 *:

```
> v = rnorm(35, mean = 1, sd = 2)
> matrix(v, nrow = 5, ncol = 7)
```

```
           [,1]       [,2]      [,3]       [,4]       [,5]     [,6]      [,7]
[1,]  2.6971459  5.8434895  2.203829  0.2697864 -2.1693346 1.337511 0.4001539
[2,]  1.1068561  0.6153204 -2.564824  3.8515949 -0.8838222 6.359263 2.2532027
[3,]  3.7851389 -1.8312958  2.713610  5.3572793 -0.2098972 4.807966 4.7708415
[4,] -0.5540674  0.8865879 -1.059174  1.2232390 -1.5476410 2.853220 0.8654130
[5,]  3.7553937 -3.2673808 -1.072717 -2.7902024 -1.8729281 3.126770 0.6150268
```

Exercise 9.3 : nothing to do