IS609 Homework Week 5

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1) Consider a model for the long-term dining behavior of the students at College USA. It is found that 25% of the students who eat at the college's Grease Dining Hall return to eat there again, wheras those who eat at Sweet Dining Hall have a 93% return rate. These are the only two dining halls available on campus, and assume that all students eat at one of these halls. Formulate a model to solve for the long-term percentage of students eating at each hall.

Based on the parameters of the problem

25% return rate at Grease, 75% at Sweet 93% return rate at Sweet, 7% at Grease

```
model <- function(Snaught, Gnaught)
{
  sweet <- Snaught
  grease <- Gnaught

  df <- data.frame(i=c(0), Sweet=c(sweet), Grease=c(grease))
  for(i in 1:100)
  {
    sweet1 <- 0.25 * grease + 0.07 * sweet
    grease1 <- 0.75 * grease + 0.93 * sweet
    sweet <- sweet1
    grease <- grease1
    df <- rbind(df, cbind(i=c(i), Sweet=sweet, Grease=grease))
  }
  return(df)
}

Snaught <- 50
Gnaught <- 50
df5050 <- model(Snaught, Gnaught)
knitr::kable(head(df5050,20))
```

i	Sweet	Grease
0	50.00000	50.00000
1	16.00000	84.00000
2	22.12000	77.88000
3	21.01840	78.98160
4	21.21669	78.78331
5	21.18100	78.81900
6	21.18742	78.81258
7	21.18626	78.81374

i	Sweet	Grease
8	21.18647	78.81353
9	21.18643	78.81356
10	21.18644	78.81356
11	21.18644	78.81356
12	21.18644	78.81356
13	21.18644	78.81356
14	21.18644	78.81356
15	21.18644	78.81356
16	21.18644	78.81356
17	21.18644	78.81356
18	21.18644	78.81356
19	21.18644	78.81356

Steady state is reached after 10 iterations.

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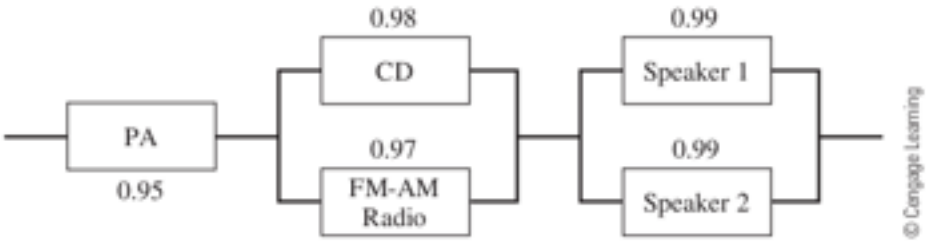
1) Consider a stereo with CD player, FM-AM radio tuner, speakers (dual), and power amplifier (PA) componenets, as displayed with the reliabilities shown in Figure 6.11. Determine the system's reliability. What assumptions are required in your model?




```
#Speakers are in parallel
speakers <- 0.99 + 0.99 - (0.99*0.99)
speakers
```

```
## [1] 0.9999
```

```
#radio and CD in parallel
radiocd <- 0.98 + 0.97 - (0.98*0.97)
radiocd
```

```
## [1] 0.9994
```

```
#PA is solo
PA <- 0.95

reliability <- PA * radiocd * speakers
reliability
```

```
## [1] 0.9493351
```

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Use the basic linear model y = ax+b to fit the folowing data sets. Provide the model, provide the values of SSE, SSR, and R^2, and provide a residual plot.

1) For table 2.7, predict weight as function of height

Table 2.7 Weight versus height for males aged 17–21

Height (in.)	Weight (lb)	Height (in.)	Weight (lb)
60	132	71	185
61	136	72	190
62	141	73	195
63	145	74	201
64	150	75	206
65	155	76	212
66	160	77	218
67	165	78	223
68	170	79	229
69	175	80	234
70	180		


```
height <- c(60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75,
    76, 77, 78, 79, 80)
weight <- c(132, 136, 141, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190,
    195, 201, 206, 212, 218, 223, 229, 234)
df <- data.frame(height, weight)

m <- nrow(df)

a <- (m * sum(df$height * df$weight) - sum(df$height) * sum(df$weight))/(m *
    sum(df$height^2) - sum(df$height)^2)

b <- (sum(df$height^2) * sum(df$weight) - sum(df$height * df$weight) * sum(df$height))/(m *
    sum(df$height^2) - sum(df$height)^2)

# linear regression model

# SSE
SSE <- sum((df$weight - (a * df$height + b))^2)
SSE
```

```
## [1] 24.6342
```

```
# SST
ybar <- mean(df$weight)
SST <- sum((df$weight - ybar)^2)
SST
```

```
## [1] 20338.95
```

```
# SSR
SSR <- SST - SSE
SSR
```

```
## [1] 20314.32
```

```
# Coefficient of determination
R2 <- 1 - (SSE/SST)
R2
```

```
## [1] 0.9987888
```

```
df$y_hat <- (a * df$height + b)
df$residual <- df$weight - df$y_hat
head(df)
```

```
##   height weight    y_hat    residual
## 1     60    132 129.6840  2.31601732
## 2     61    136 134.8203  1.17965368
## 3     62    141 139.9567  1.04329004
## 4     63    145 145.0931 -0.09307359
## 5     64    150 150.2294 -0.22943723
## 6     65    155 155.3658 -0.36580087
```