

Homework 2: Programming in Base R

Mike Maccia

Task 1: Basic Vector Practice

Question 1

Pre and Post blood pressure measurements in a medical experiment in 2 vectors.

```
pre <- c (130,128,116,124,133,134,118,126,114,127,141,138,128,140,137,131,120,  
         128,139,135)  
post <- c(114,98,113,99,107,116,113,111,119,117,101,119,130,122,106,106,124,  
         102,117,113)
```

Question 2

Assigning subject names to vector elements

```
subname <- paste("Subject", 1:20, sep = '_')  
names(pre) <- subname  
names(post) <- subname
```

Question 3

Change in blood pressure from pre- to post-treatments.

```
diff_op <- (pre - post)  
  
diff_op
```

Subject_1	Subject_2	Subject_3	Subject_4	Subject_5	Subject_6	Subject_7
16	30	3	25	26	18	5
Subject_8	Subject_9	Subject_10	Subject_11	Subject_12	Subject_13	Subject_14
15	-5	10	40	19	-2	18
Subject_15	Subject_16	Subject_17	Subject_18	Subject_19	Subject_20	
31	25	-4	26	22	22	

Question 4

Mean decrease in blood pressure across all patients.

```
mean(diff_op)
```

```
[1] 17
```

Question 5

Only patients that had a decrease in blood pressure.

```
which(diff_op > 0)
```

Subject_1	Subject_2	Subject_3	Subject_4	Subject_5	Subject_6	Subject_7
1	2	3	4	5	6	7
Subject_8	Subject_10	Subject_11	Subject_12	Subject_14	Subject_15	Subject_16
8	10	11	12	14	15	16
Subject_18	Subject_19	Subject_20				
18	19	20				

Question 6

Subset patients out with a positive decrease.

```
positivediff_op <- diff_op [diff_op > 0]
print(positivediff_op)
```

Subject_1	Subject_2	Subject_3	Subject_4	Subject_5	Subject_6	Subject_7
16	30	3	25	26	18	5
Subject_8	Subject_10	Subject_11	Subject_12	Subject_14	Subject_15	Subject_16
15	10	40	19	18	31	25
Subject_18	Subject_19	Subject_20				
26	22	22				

Question 7

The average difference in blood pressure in patients where blood pressure decreased.

```
mean(positivediff_op)
```

```
[1] 20.64706
```

Task 2: Basic Data Frame Practice

Question 1

Build data frame using treatment results from Task 1.

```
patient <- names(pre)
pre_bp <- pre
post_bp <- post
diff_bp <- diff_op
bp_df <- data.frame(patient,pre_bp,post_bp,diff_bp,row.names = NULL)
bp_df
```

	patient	pre_bp	post_bp	diff_bp
1	Subject_1	130	114	16
2	Subject_2	128	98	30
3	Subject_3	116	113	3
4	Subject_4	124	99	25
5	Subject_5	133	107	26
6	Subject_6	134	116	18
7	Subject_7	118	113	5
8	Subject_8	126	111	15
9	Subject_9	114	119	-5
10	Subject_10	127	117	10
11	Subject_11	141	101	40
12	Subject_12	138	119	19
13	Subject_13	128	130	-2
14	Subject_14	140	122	18
15	Subject_15	137	106	31
16	Subject_16	131	106	25
17	Subject_17	120	124	-4
18	Subject_18	128	102	26
19	Subject_19	139	117	22
20	Subject_20	135	113	22

Question 2

Displaying patients with a rise in blood pressure.

```
negbp_diff <- bp_df [bp_df$diff_bp < 0,,drop=FALSE]  
negbp_diff
```

	patient	pre_bp	post_bp	diff_bp
9	Subject_9	114	119	-5
13	Subject_13	128	130	-2
17	Subject_17	120	124	-4

Question 3

Adding a column to indicate patients with a post blood pressure < 120.

```
bp_df$post_bp_norm <- bp_df$post_bp < 120  
  
knitr::kable(bp_df)
```

patient	pre_bp	post_bp	diff_bp	post_bp_norm
Subject_1	130	114	16	TRUE
Subject_2	128	98	30	TRUE
Subject_3	116	113	3	TRUE
Subject_4	124	99	25	TRUE
Subject_5	133	107	26	TRUE
Subject_6	134	116	18	TRUE
Subject_7	118	113	5	TRUE
Subject_8	126	111	15	TRUE
Subject_9	114	119	-5	TRUE
Subject_10	127	117	10	TRUE
Subject_11	141	101	40	TRUE
Subject_12	138	119	19	TRUE
Subject_13	128	130	-2	FALSE
Subject_14	140	122	18	FALSE
Subject_15	137	106	31	TRUE
Subject_16	131	106	25	TRUE
Subject_17	120	124	-4	FALSE
Subject_18	128	102	26	TRUE
Subject_19	139	117	22	TRUE

patient	pre_bp	post_bp	diff_bp	post_bp_norm
Subject_20	135	113	22	TRUE

Task 3: List Practice

Question 1

Second data frame to show pre- and post-bp in patients who took placebo.

```
pre_placebo <- c (138,135,147,117,152,134,114,121,131,130)
post_placebo <- c(105,136,123,130,134,143,135,139,120,124)

subname2 <- paste("Subject", 1:10, sep = '_')
names(pre_placebo) <- subname2
names(post_placebo) <-subname2

diff_placebo <- (pre_placebo - post_placebo)

patient <- subname2
pre_bp <- pre_placebo
post_bp <- post_placebo
diff_bp <- diff_placebo
bp_df_placebo <- data.frame(patient,pre_bp,post_bp,diff_bp,row.names = NULL)

bp_df_placebo$postbpnormal <- bp_df_placebo$post_bp < 120

bp_df_placebo
```

	patient	pre_bp	post_bp	diff_bp	postbpnormal
1	Subject_1	138	105	33	TRUE
2	Subject_2	135	136	-1	FALSE
3	Subject_3	147	123	24	FALSE
4	Subject_4	117	130	-13	FALSE
5	Subject_5	152	134	18	FALSE
6	Subject_6	134	143	-9	FALSE
7	Subject_7	114	135	-21	FALSE
8	Subject_8	121	139	-18	FALSE
9	Subject_9	131	120	11	FALSE
10	Subject_10	130	124	6	FALSE

Question 2

Create a list with both treatment and placebo elements.

```
bp_list <- list(treatment = bp_df, placebo = bp_df_placebo)
print(bp_list)
```

\$treatment

	patient	pre_bp	post_bp	diff_bp	post_bp_norm
1	Subject_1	130	114	16	TRUE
2	Subject_2	128	98	30	TRUE
3	Subject_3	116	113	3	TRUE
4	Subject_4	124	99	25	TRUE
5	Subject_5	133	107	26	TRUE
6	Subject_6	134	116	18	TRUE
7	Subject_7	118	113	5	TRUE
8	Subject_8	126	111	15	TRUE
9	Subject_9	114	119	-5	TRUE
10	Subject_10	127	117	10	TRUE
11	Subject_11	141	101	40	TRUE
12	Subject_12	138	119	19	TRUE
13	Subject_13	128	130	-2	FALSE
14	Subject_14	140	122	18	FALSE
15	Subject_15	137	106	31	TRUE
16	Subject_16	131	106	25	TRUE
17	Subject_17	120	124	-4	FALSE
18	Subject_18	128	102	26	TRUE
19	Subject_19	139	117	22	TRUE
20	Subject_20	135	113	22	TRUE

\$placebo

	patient	pre_bp	post_bp	diff_bp	postbpnormal
1	Subject_1	138	105	33	TRUE
2	Subject_2	135	136	-1	FALSE
3	Subject_3	147	123	24	FALSE
4	Subject_4	117	130	-13	FALSE
5	Subject_5	152	134	18	FALSE
6	Subject_6	134	143	-9	FALSE
7	Subject_7	114	135	-21	FALSE
8	Subject_8	121	139	-18	FALSE
9	Subject_9	131	120	11	FALSE
10	Subject_10	130	124	6	FALSE

Question 3

Accessing first list element using:

- Single square brackets

```
bp_list[1]
```

```
$treatment
```

	patient	pre_bp	post_bp	diff_bp	post_bp_norm
1	Subject_1	130	114	16	TRUE
2	Subject_2	128	98	30	TRUE
3	Subject_3	116	113	3	TRUE
4	Subject_4	124	99	25	TRUE
5	Subject_5	133	107	26	TRUE
6	Subject_6	134	116	18	TRUE
7	Subject_7	118	113	5	TRUE
8	Subject_8	126	111	15	TRUE
9	Subject_9	114	119	-5	TRUE
10	Subject_10	127	117	10	TRUE
11	Subject_11	141	101	40	TRUE
12	Subject_12	138	119	19	TRUE
13	Subject_13	128	130	-2	FALSE
14	Subject_14	140	122	18	FALSE
15	Subject_15	137	106	31	TRUE
16	Subject_16	131	106	25	TRUE
17	Subject_17	120	124	-4	FALSE
18	Subject_18	128	102	26	TRUE
19	Subject_19	139	117	22	TRUE
20	Subject_20	135	113	22	TRUE

- Double Square Brackets

```
bp_list[[1]]
```

	patient	pre_bp	post_bp	diff_bp	post_bp_norm
1	Subject_1	130	114	16	TRUE
2	Subject_2	128	98	30	TRUE
3	Subject_3	116	113	3	TRUE
4	Subject_4	124	99	25	TRUE
5	Subject_5	133	107	26	TRUE
6	Subject_6	134	116	18	TRUE

7	Subject_7	118	113	5	TRUE
8	Subject_8	126	111	15	TRUE
9	Subject_9	114	119	-5	TRUE
10	Subject_10	127	117	10	TRUE
11	Subject_11	141	101	40	TRUE
12	Subject_12	138	119	19	TRUE
13	Subject_13	128	130	-2	FALSE
14	Subject_14	140	122	18	FALSE
15	Subject_15	137	106	31	TRUE
16	Subject_16	131	106	25	TRUE
17	Subject_17	120	124	-4	FALSE
18	Subject_18	128	102	26	TRUE
19	Subject_19	139	117	22	TRUE
20	Subject_20	135	113	22	TRUE

- By Name

```
bp_list$treatment
```

	patient	pre_bp	post_bp	diff_bp	post_bp_norm
1	Subject_1	130	114	16	TRUE
2	Subject_2	128	98	30	TRUE
3	Subject_3	116	113	3	TRUE
4	Subject_4	124	99	25	TRUE
5	Subject_5	133	107	26	TRUE
6	Subject_6	134	116	18	TRUE
7	Subject_7	118	113	5	TRUE
8	Subject_8	126	111	15	TRUE
9	Subject_9	114	119	-5	TRUE
10	Subject_10	127	117	10	TRUE
11	Subject_11	141	101	40	TRUE
12	Subject_12	138	119	19	TRUE
13	Subject_13	128	130	-2	FALSE
14	Subject_14	140	122	18	FALSE
15	Subject_15	137	106	31	TRUE
16	Subject_16	131	106	25	TRUE
17	Subject_17	120	124	-4	FALSE
18	Subject_18	128	102	26	TRUE
19	Subject_19	139	117	22	TRUE
20	Subject_20	135	113	22	TRUE

Question 4

Access placebo, pre-bp column in 1 line

```
bp_list$treatment$pre_bp
```

```
[1] 130 128 116 124 133 134 118 126 114 127 141 138 128 140 137 131 120 128 139  
[20] 135
```

Task 4 Control Flow Practice

Question 3

Create new column for characterization of bp.

- Optimal: ≤ 120
- Borderline: $120 < \text{bp} \leq 130$
- High: > 130

```
bp_list$treatment$status <-character(20)  
bp_list$placebo$status <-character(10)
```

Question 2

Create loop for status in treatment element.

```
for (i in 1:nrow(bp_list$treatment)){  
  if (bp_list$treatment$post_bp[i] <= 120){  
    bp_list$treatment$status[i] <-"optimal"  
  }  
  else if (bp_list$treatment$post_bp[i] >120  
    && bp_list$treatment$post_bp[i]<=130){  
    bp_list$treatment$status[i] <-"borderline"  
  }  
  else if (bp_list$treatment$post_bp[i] >130){  
    bp_list$treatment$status[i] <-"high"  
  }  
}
```

```
}
bp_list$treatment
```

	patient	pre_bp	post_bp	diff_bp	post_bp_norm	status
1	Subject_1	130	114	16	TRUE	optimal
2	Subject_2	128	98	30	TRUE	optimal
3	Subject_3	116	113	3	TRUE	optimal
4	Subject_4	124	99	25	TRUE	optimal
5	Subject_5	133	107	26	TRUE	optimal
6	Subject_6	134	116	18	TRUE	optimal
7	Subject_7	118	113	5	TRUE	optimal
8	Subject_8	126	111	15	TRUE	optimal
9	Subject_9	114	119	-5	TRUE	optimal
10	Subject_10	127	117	10	TRUE	optimal
11	Subject_11	141	101	40	TRUE	optimal
12	Subject_12	138	119	19	TRUE	optimal
13	Subject_13	128	130	-2	FALSE	borderline
14	Subject_14	140	122	18	FALSE	borderline
15	Subject_15	137	106	31	TRUE	optimal
16	Subject_16	131	106	25	TRUE	optimal
17	Subject_17	120	124	-4	FALSE	borderline
18	Subject_18	128	102	26	TRUE	optimal
19	Subject_19	139	117	22	TRUE	optimal
20	Subject_20	135	113	22	TRUE	optimal

Question 3

Repeat above loop for placebo element.

```
for (i in 1:nrow(bp_list$placebo)){
  if (bp_list$placebo$post_bp[i] <= 120){
    bp_list$placebo$status[i] <-"optimal"
  }
  else if (bp_list$placebo$post_bp[i] >120
    && bp_list$placebo$post_bp[i]<=130){
    bp_list$placebo$status[i] <-"borderline"
  }
  else if (bp_list$placebo$post_bp[i] >130){
    bp_list$placebo$status[i] <-"high"
  }
}
```

```

}
}
bp_list$placebo

```

	patient	pre_bp	post_bp	diff_bp	postbpnormal	status
1	Subject_1	138	105	33	TRUE	optimal
2	Subject_2	135	136	-1	FALSE	high
3	Subject_3	147	123	24	FALSE	borderline
4	Subject_4	117	130	-13	FALSE	borderline
5	Subject_5	152	134	18	FALSE	high
6	Subject_6	134	143	-9	FALSE	high
7	Subject_7	114	135	-21	FALSE	high
8	Subject_8	121	139	-18	FALSE	high
9	Subject_9	131	120	11	FALSE	optimal
10	Subject_10	130	124	6	FALSE	borderline

Task 5: Function Writing

Question 1

Writing a Function that can input mean, var, SD, min, max and output the results for pre-, post-, and difference in blood pressure for both groups.

```

statbp_func <- function(bp_list, stat="mean"){ #function using the bp_list,
  #then we can pick stat. Mean should be defaulted.

  df_choice <- c("treatment","placebo") #2 df to reference from list
  bp_type <- c('pre_bp', 'post_bp', 'diff_bp') #where to get numbers from

  values <-c() #need to make 2 vectors for results to go into
  stat_name <-c()

  my_fun <- get(stat) #function to apply statistic as desired

  #need loop to get the right data frame and then the stat of choice

  for (i in df_choice) {
    for (j in bp_type){

      num_column <- as.numeric(as.character(bp_list[[i]][[j]]))
    }
  }
}

```

```

    value <- my_fun (num_column, na.rm=T)
    values <- c(values, value)
    name <- paste(stat, j, sep="_")
    stat_name <- c(stat_name, name)
  }
}
#use the other vectors and results to return the data for each group
names(values) <-stat_name
return (values)
}

```

Applying mean.

```

statbp_func_print <- statbp_func(bp_list, "mean")

statbp_func_print

```

mean_pre_bp	mean_post_bp	mean_diff_bp	mean_pre_bp	mean_post_bp	mean_diff_bp
129.35	112.35	17.00	131.90	128.90	3.00

Applying variance.

```

statbp_func_print <- statbp_func(bp_list, "var")

statbp_func_print

```

var_pre_bp	var_post_bp	var_diff_bp	var_pre_bp	var_post_bp	var_diff_bp
64.55526	74.76579	153.68421	149.87778	124.98889	341.33333

Applying standard deviation.

```

statbp_func_print <- statbp_func(bp_list, "sd")

statbp_func_print

```

sd_pre_bp	sd_post_bp	sd_diff_bp	sd_pre_bp	sd_post_bp	sd_diff_bp
8.034629	8.646721	12.396944	12.242458	11.179843	18.475209

Applying min.

```
statbp_func_print <- statbp_func(bp_list, "min")
```

```
statbp_func_print
```

min_pre_bp	min_post_bp	min_diff_bp	min_pre_bp	min_post_bp	min_diff_bp
114	98	-5	114	105	-21

Applying max.

```
statbp_func_print <- statbp_func(bp_list, "max")
```

```
statbp_func_print
```

max_pre_bp	max_post_bp	max_diff_bp	max_pre_bp	max_post_bp	max_diff_bp
141	130	40	152	143	33