Programming in Base R

Task 1: Basic Vector practice

Question 1

```
pre <- c(130, 128, 116, 124, 133, 134, 118, 126, 114, 127, 141, 138, 128,
           140, 137, 131, 120, 128, 139, 135)

pre
```

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

```
post <- c(114, 98, 113, 99, 107, 116, 113, 111, 119, 117, 101, 119, 130,
            122, 106, 106, 124, 102, 117, 113)

post
```

```
 [1] 114  98 113  99 107 116 113 111 119 117 101 119 130 122 106 106 124 102 117
[20] 113
```

Question 2

```
r_object <- paste("Subject", 1:20, sep = "_")

r_object
```

```
 [1] "Subject_1"  "Subject_2"  "Subject_3"  "Subject_4"  "Subject_5"
 [6] "Subject_6"  "Subject_7"  "Subject_8"  "Subject_9"  "Subject_10"
[11] "Subject_11" "Subject_12" "Subject_13" "Subject_14" "Subject_15"
[16] "Subject_16" "Subject_17" "Subject_18" "Subject_19" "Subject_20"
```

```
names(pre) <- r_object

pre
```

```
 Subject_1  Subject_2  Subject_3  Subject_4  Subject_5  Subject_6  Subject_7
       130        128        116        124        133        134        118
 Subject_8  Subject_9 Subject_10 Subject_11 Subject_12 Subject_13 Subject_14
       126        114        127        141        138        128        140
Subject_15 Subject_16 Subject_17 Subject_18 Subject_19 Subject_20
       137        131        120        128        139        135
```

```
names(post) <- r_object

post
```

```
 Subject_1  Subject_2  Subject_3  Subject_4  Subject_5  Subject_6  Subject_7
       114         98        113         99        107        116        113
 Subject_8  Subject_9 Subject_10 Subject_11 Subject_12 Subject_13 Subject_14
       111        119        117        101        119        130        122
Subject_15 Subject_16 Subject_17 Subject_18 Subject_19 Subject_20
       106        106        124        102        117        113
```

Question 3

```
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(diff_op)
```

```
[1] 17
```

Question 5

```
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

```
diff_op_pos <- diff_op[which(diff_op > 0)]

diff_op_pos
```

```
 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

```
mean(diff_op_pos)
```

```
[1] 20.64706
```

Task 2: Basic Data Frame practice

Question 1

```
df <- data.frame(patient = r_object, pre_bp = pre, post_bp = post,
                 diff_bp = diff_op)

df
```

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

Question 2

```
subset(df, df$diff_bp < 0)
```

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

Question 3

```
normal <- ifelse(df$post_bp < 120, "TRUE", "")

df$normal <- normal

df$normal
```

```
 [1] "TRUE" "TRUE" "TRUE" "TRUE" "TRUE" "TRUE" "TRUE" "TRUE" "TRUE" "TRUE"
[11] "TRUE" "TRUE" ""     ""     "TRUE" "TRUE" ""     "TRUE" "TRUE" "TRUE"
```

Question 4

```
knitr::kable(df)
```

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

Task 3: List practice

Question 1

```
pre_bp <- c(138, 135, 147, 117, 152, 134, 114, 121, 131, 130)

post_bp <- c(105, 136, 123, 130, 134, 143, 135, 139, 120, 124)

patient <- paste("Subject", 1:10, sep = "_")

names(pre_bp) <- patient

names(post_bp) <- patient

diff_bp <- pre_bp-post_bp

bp_df_placebo <- data.frame(patient, pre_bp, post_bp, diff_bp)

normal <- ifelse(bp_df_placebo$post_bp < 120, "TRUE", "")

bp_df_placebo$normal <- normal

bp_df_placebo
```

```
             patient pre_bp post_bp diff_bp normal
Subject_1   Subject_1    138     105      33   TRUE
Subject_2   Subject_2    135     136      -1
Subject_3   Subject_3    147     123      24
Subject_4   Subject_4    117     130     -13
Subject_5   Subject_5    152     134      18
Subject_6   Subject_6    134     143      -9
Subject_7   Subject_7    114     135     -21
Subject_8   Subject_8    121     139     -18
Subject_9   Subject_9    131     120      11
Subject_10 Subject_10    130     124       6
```

Question 2

```r
bp_list <- list(treatment = df, placebo = bp_df_placebo)

bp_list
```

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

$placebo
              patient pre_bp post_bp diff_bp normal
Subject_1   Subject_1    138     105      33   TRUE
Subject_2   Subject_2    135     136      -1
Subject_3   Subject_3    147     123      24
Subject_4   Subject_4    117     130     -13
Subject_5   Subject_5    152     134      18
Subject_6   Subject_6    134     143      -9
Subject_7   Subject_7    114     135     -21
Subject_8   Subject_8    121     139     -18
Subject_9   Subject_9    131     120      11
Subject_10 Subject_10    130     124       6
```

Question 3

```
bp_list[1]
```

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

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

```
              patient pre_bp post_bp diff_bp normal
Subject_1   Subject_1    130     114      16   TRUE
Subject_2   Subject_2    128      98      30   TRUE
Subject_3   Subject_3    116     113       3   TRUE
Subject_4   Subject_4    124      99      25   TRUE
Subject_5   Subject_5    133     107      26   TRUE
Subject_6   Subject_6    134     116      18   TRUE
Subject_7   Subject_7    118     113       5   TRUE
Subject_8   Subject_8    126     111      15   TRUE
Subject_9   Subject_9    114     119      -5   TRUE
Subject_10 Subject_10    127     117      10   TRUE
```

```
Subject_11 Subject_11    141     101      40   TRUE
Subject_12 Subject_12    138     119      19   TRUE
Subject_13 Subject_13    128     130      -2
Subject_14 Subject_14    140     122      18
Subject_15 Subject_15    137     106      31   TRUE
Subject_16 Subject_16    131     106      25   TRUE
Subject_17 Subject_17    120     124      -4
Subject_18 Subject_18    128     102      26   TRUE
Subject_19 Subject_19    139     117      22   TRUE
Subject_20 Subject_20    135     113      22   TRUE
```

```
bp_list$treatment
```

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

Question 4

```
bp_list$placebo$pre_bp
```

```
 [1] 138 135 147 117 152 134 114 121 131 130
```

Task 4: Control Flow Practice

Question 1

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

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

Question 2

```
for(i in 1:20){
  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$treatment$status
```

```
 [1] "optimal"    "optimal"    "optimal"    "optimal"    "optimal"
 [6] "optimal"    "optimal"    "optimal"    "optimal"    "optimal"
[11] "optimal"    "optimal"    "borderline" "borderline" "optimal"
[16] "optimal"    "borderline" "optimal"    "optimal"    "optimal"
```

Question 3

```
for(i in 1:10){
  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$placebo$status
```

```
 [1] "optimal"    "high"       "borderline" "borderline" "high"
 [6] "high"       "high"       "high"       "optimal"    "borderline"
```

Task 5: Function Writing

Question 1

```
returning_six_values <- function(treatment, placebo, stat = "mean"){
  my_fun <- get(stat)

  vector_names <- c("of Pre-BP (Treatment)", "of Post-BP (Treatment)",
                    "of BP Difference (Treatment)", "of Pre-BP (Placebo)",
                    "of Post-BP (Placebo)", "of BP Difference (Placebo)")

  vector_names <- paste(stat, vector_names)

  vector_values <- c(my_fun(treatment$pre_bp), my_fun(treatment$post_bp),
                     my_fun(treatment$diff_bp), my_fun(placebo$pre_bp),
                     my_fun(placebo$post_bp), my_fun(placebo$diff_bp))

  names(vector_values) <- vector_names

  return(vector_values)
}

returning_six_values(bp_list$treatment, bp_list$placebo)
```

```
       mean of Pre-BP (Treatment)       mean of Post-BP (Treatment)
                           129.35                            112.35
mean of BP Difference (Treatment)          mean of Pre-BP (Placebo)
                            17.00                            131.90
        mean of Post-BP (Placebo)   mean of BP Difference (Placebo)
                           128.90                              3.00
```

```r
returning_six_values(bp_list$treatment, bp_list$placebo, "var")
```

```
       var of Pre-BP (Treatment)       var of Post-BP (Treatment)
                         64.55526                         74.76579
var of BP Difference (Treatment)          var of Pre-BP (Placebo)
                        153.68421                        149.87778
        var of Post-BP (Placebo)   var of BP Difference (Placebo)
                        124.98889                        341.33333
```

```r
returning_six_values(bp_list$treatment, bp_list$placebo, "sd")
```

```
       sd of Pre-BP (Treatment)       sd of Post-BP (Treatment)
                       8.034629                        8.646721
sd of BP Difference (Treatment)          sd of Pre-BP (Placebo)
                      12.396944                       12.242458
        sd of Post-BP (Placebo)   sd of BP Difference (Placebo)
                      11.179843                       18.475209
```

```r
returning_six_values(bp_list$treatment, bp_list$placebo, "min")
```

```
       min of Pre-BP (Treatment)       min of Post-BP (Treatment)
                             114                              98
min of BP Difference (Treatment)          min of Pre-BP (Placebo)
                              -5                             114
        min of Post-BP (Placebo)   min of BP Difference (Placebo)
                             105                             -21
```

```r
returning_six_values(bp_list$treatment, bp_list$placebo, "max")
```

```
       max of Pre-BP (Treatment)       max of Post-BP (Treatment)
                             141                             130
max of BP Difference (Treatment)          max of Pre-BP (Placebo)
                              40                             152
        max of Post-BP (Placebo)   max of BP Difference (Placebo)
                             143                              33
```