Programming in Base R

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Task 1: Basic Vector practice

Question 1

```
#Create vectors of bp levels at pre and post treatment
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

```
#Assign subject names
patient<-paste("Subject",1:20,sep="_")
names(pre)<-patient
names(post)<-patient
```

Question 3

```
#Calculate the change in blood pressure
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

```
#Calculate the average decrease in blood pressure across all patients
avg_decrease<-mean(diff_op)
avg_decrease
```

```
[1] 17
```

Question 5

```
#Determine which patients experienced a decrease in blood pressure
#after treatment
positive_change<-which(diff_op>0)
positive_change
```

```
 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 the vector of differences to only return those that have
#a positive change
diff_op_positive_change<-diff_op[positive_change]
diff_op_positive_change
```

```
 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

```
#Calculate the average decrease in blood pressure for those where
#the blood pressure decreased
mean(diff_op_positive_change)
```

```
[1] 20.64706
```

Task 2: Basic Data Frame practice

Question 1

```
#Create a data frame of patient, pre_bp, post_bp, and diff_bp
experiment<-data.frame(patient,pre_bp=pre,post_bp=post,diff_bp=diff_op)
experiment
```

```
             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

```
#Return only rows where the diff_bp column is negative
experiment[which(experiment[,4]<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

```
#Add a new column to the data frame corresponding to TRUE if
#the post_bp is less than 120
experiment$post_bp_less_than_120<- experiment[,3]<120
```

Question 4

```
#Print out the final data frame
knitr::kable(experiment)
```

	patient	pre_bp	post_bp	diff_bp	post_bp_less_than_120
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

	patient	pre_bp	post_bp	diff_bp	post_bp_less_than_120
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	FALSE
Subject_14	Subject_14	140	122	18	FALSE
Subject_15	Subject_15	137	106	31	TRUE
Subject_16	Subject_16	131	106	25	TRUE
Subject_17	Subject_17	120	124	-4	FALSE
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

```
#Create a new data frame with new experiment data
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_op<-pre_bp-post_bp
bp_df_placebo<-data.frame(patient,pre_bp,post_bp,diff_bp=diff_op)
bp_df_placebo$post_bp_less_than_120<- bp_df_placebo[,3]<120
bp_df_placebo
```

```
             patient pre_bp post_bp diff_bp post_bp_less_than_120
Subject_1   Subject_1    138     105      33                  TRUE
Subject_2   Subject_2    135     136      -1                 FALSE
Subject_3   Subject_3    147     123      24                 FALSE
Subject_4   Subject_4    117     130     -13                 FALSE
Subject_5   Subject_5    152     134      18                 FALSE
Subject_6   Subject_6    134     143      -9                 FALSE
Subject_7   Subject_7    114     135     -21                 FALSE
Subject_8   Subject_8    121     139     -18                 FALSE
Subject_9   Subject_9    131     120      11                 FALSE
Subject_10 Subject_10    130     124       6                 FALSE
```

Question 2

```
#Create and store a list with both the treatment and placebo elements
bp_list<-list(treatment=experiment,placebo=bp_df_placebo)
```

Question 3

```
#Access the first list element using three different types of syntax
bp_list[1]
```

```
$treatment
              patient pre_bp post_bp diff_bp post_bp_less_than_120
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                  FALSE
Subject_14 Subject_14    140     122      18                  FALSE
Subject_15 Subject_15    137     106      31                   TRUE
Subject_16 Subject_16    131     106      25                   TRUE
Subject_17 Subject_17    120     124      -4                  FALSE
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 post_bp_less_than_120
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                 FALSE
Subject_14 Subject_14    140     122      18                 FALSE
Subject_15 Subject_15    137     106      31                  TRUE
Subject_16 Subject_16    131     106      25                  TRUE
Subject_17 Subject_17    120     124      -4                 FALSE
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 post_bp_less_than_120
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                 FALSE
Subject_14 Subject_14    140     122      18                 FALSE
Subject_15 Subject_15    137     106      31                  TRUE
Subject_16 Subject_16    131     106      25                  TRUE
Subject_17 Subject_17    120     124      -4                 FALSE
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

```
#Access the placebo data frame, pre_bp column
bp_list[[2]][,2]
```

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

Task 4: Control Flow Practice

Question 1

```
#Create a column called status in each data frame in the list
bp_list$treatment$status<-character(20)
bp_list$placebo$status<-character(10)
```

Question 2

```
#For the treatment data frame (within the list),
#create a for loop and use if/then/else logic to
#create the status column's values
for(i in seq_along(bp_list$treatment[,1])){
  if(bp_list$treatment[i,3]<=120){
    bp_list$treatment[i,6]<-"optimal"
  }else if(bp_list$treatment[i,3]>120 & bp_list$treatment[i,3]<=130){
    bp_list$treatment[i,6]<-"borderline"
  }else if(bp_list$treatment[i,3]>130){
    bp_list$treatment[i,6]<-"high"
  }
}

bp_list$treatment
```

```
            patient pre_bp post_bp diff_bp post_bp_less_than_120     status
Subject_1   Subject_1    130     114      16                  TRUE    optimal
Subject_2   Subject_2    128      98      30                  TRUE    optimal
Subject_3   Subject_3    116     113       3                  TRUE    optimal
Subject_4   Subject_4    124      99      25                  TRUE    optimal
```

```
Subject_5   Subject_5    133     107      26                 TRUE    optimal
Subject_6   Subject_6    134     116      18                 TRUE    optimal
Subject_7   Subject_7    118     113       5                 TRUE    optimal
Subject_8   Subject_8    126     111      15                 TRUE    optimal
Subject_9   Subject_9    114     119      -5                 TRUE    optimal
Subject_10 Subject_10    127     117      10                 TRUE    optimal
Subject_11 Subject_11    141     101      40                 TRUE    optimal
Subject_12 Subject_12    138     119      19                 TRUE    optimal
Subject_13 Subject_13    128     130      -2                FALSE borderline
Subject_14 Subject_14    140     122      18                FALSE borderline
Subject_15 Subject_15    137     106      31                 TRUE    optimal
Subject_16 Subject_16    131     106      25                 TRUE    optimal
Subject_17 Subject_17    120     124      -4                FALSE borderline
Subject_18 Subject_18    128     102      26                 TRUE    optimal
Subject_19 Subject_19    139     117      22                 TRUE    optimal
Subject_20 Subject_20    135     113      22                 TRUE    optimal
```

Question 3

```r
#For the placebo data frame (within the list),
#create a for loop and use if/then/else logic to
#create the status column's values
for(i in seq_along(bp_list$placebo[,1])){
  if(bp_list$placebo[i,3]<=120){
    bp_list$placebo[i,6]<-"optimal"
  }else if(bp_list$placebo[i,3]>120 & bp_list$placebo[i,3]<=130){
    bp_list$placebo[i,6]<-"borderline"
  }else if(bp_list$placebo[i,3]>130){
    bp_list$placebo[i,6]<-"high"
  }
}

bp_list$placebo
```

```
             patient pre_bp post_bp diff_bp post_bp_less_than_120     status
Subject_1   Subject_1    138     105      33                 TRUE    optimal
Subject_2   Subject_2    135     136      -1                FALSE       high
Subject_3   Subject_3    147     123      24                FALSE borderline
Subject_4   Subject_4    117     130     -13                FALSE borderline
Subject_5   Subject_5    152     134      18                FALSE       high
```

```
Subject_6   Subject_6    134      143       -9                 FALSE       high
Subject_7   Subject_7    114      135      -21                 FALSE       high
Subject_8   Subject_8    121      139      -18                 FALSE       high
Subject_9   Subject_9    131      120       11                 FALSE    optimal
Subject_10 Subject_10    130      124        6                 FALSE borderline
```

Task 5: Function Writing

Question 1

```
#Write a function
SummaryStatistic<-function(list,stat="mean"){
  my_fun<-get(stat)
  pre_treatment<-my_fun(list$treatment[,2])
  post_treatment<-my_fun(list$treatment[,3])
  diff_treatment<-my_fun(list$treatment[,4])
  pre_placebo<-my_fun(list$placebo[,2])
  post_placebo<-my_fun(list$placebo[,3])
  diff_placebo<-my_fun(list$placebo[,4])
  name_of_value<-c("Pre Treatment","Post_Treatment",
                   "Diff Treatment","Pre Placebo",
                   "Post Placebo", "Diff Placebo")
  values<-c(pre_treatment,post_treatment,diff_treatment,
            pre_placebo,post_placebo,diff_placebo)
  names(values)<-paste(name_of_value,stat)
  return(list(values))
}

SummaryStatistic(bp_list)
```

```
[[1]]
 Pre Treatment mean Post_Treatment mean Diff Treatment mean    Pre Placebo mean
             129.35               112.35                17.00              131.90
  Post Placebo mean   Diff Placebo mean
             128.90                3.00
```

```
SummaryStatistic(bp_list,"var")
```

```
[[1]]
```

```
 Pre Treatment var Post_Treatment var Diff Treatment var    Pre Placebo var
          64.55526           74.76579          153.68421          149.87778
  Post Placebo var   Diff Placebo var
         124.98889          341.33333
```

```
SummaryStatistic(bp_list,"sd")
```

```
[[1]]
 Pre Treatment sd Post_Treatment sd Diff Treatment sd    Pre Placebo sd
         8.034629          8.646721         12.396944         12.242458
  Post Placebo sd   Diff Placebo sd
        11.179843         18.475209
```

```
SummaryStatistic(bp_list,"min")
```

```
[[1]]
 Pre Treatment min Post_Treatment min Diff Treatment min    Pre Placebo min
               114                  98                 -5                114
  Post Placebo min   Diff Placebo min
               105                 -21
```

```
SummaryStatistic(bp_list,"max")
```

```
[[1]]
 Pre Treatment max Post_Treatment max Diff Treatment max    Pre Placebo max
               141                 130                 40                152
  Post Placebo max   Diff Placebo max
               143                  33
```