Report for Lab Assignment 5

1.

Questions:

Spark and Smartphone/Watch Application
Implement a smart application with big data analytics related to your project showing the collaboration between Spark and Smart Apps. Note: For the big data analytics part, you can use either SparkR or Spark MLlib.

Descriptions:
Using sparkR Mlib run k means analysis and sent notifications to watch

Screenshot:

```
object HeartRateKMeans {
    def main(args: Array[String]) {

      val sparkConf = new SparkConf().setAppName("SparKMLlib").setMaster("local[*]")

      val sc = new SparkContext(sparkConf)

      // Load and parse the data
      val data = sc.textFile("data/heartRate.txt")
      val parsedData = data.map(s => Vectors.dense(s.split(' ').map(_.toDouble))).cache()

      // Cluster the data into three classes using KMeans
      val numClusters = 5
      val numIterations = 50
      val clusters = KMeans.train(parsedData, numClusters, numIterations)

      // Evaluate clustering by computing Within Set Sum of Squared Errors
      val WSSSE = clusters.computeCost(parsedData)
      println("Within Set Sum of Squared Errors = " + WSSSE)

      // Save and load model
      clusters.save(sc, "myModelPath")
      val sameModel = KMeansModel.load(sc, "myModelPath")

      // Shows the result
      println("Final Centers: ")
      sameModel.clusterCenters.foreach(println)
      // $example off$

      sc.stop()

      var s: String = "Final Centers\n"
      sameModel.clusterCenters.foreach { case (center) => {

        s += center + "\n"}
      }
```

2.

Questions:

SparkR – Extra Credit
Install Spark and Configure SparkR. Execute Word Count and K-Means Clustering algorithms using your own data (relevant to your project) with SparkR. Write a report including your algorithms and result screenshots. Modify the K-Means SparkR implementation for K-Medoids algorithm. Reference: https://amplab- extras.github.io/SparkR-pkg/

sparkR code: ./sparkR kmeans.R local "Heart rate sample data.txt" 3 9

Descriptions:
By using the specific K-means.R package and run it in sparkR, I calculated the k means for sample heart rate.

Screenshot/sparkR output file:

```
Finished iteration (delta =  86832 )
[1] 9
There were 50 or more warnings (use warnings() to see the first 50)
Final centers:
123
61
125
55
76
73
89
137
139
101
99
84
110
90
95
55
72
114
52
```

54
124
53
71
108
102
104
103
79
94
51
59
87
105
133
123
61
125
55
76
73
89
137
139
101
99
84
110
90
95
55
72
114
52
54
124
53
71
108
102
104
103
79
94
51
59

87
105
133
123
61
125
55
76
73
89
137
139
101
99
84
110
90
95
55
72
114
52
54
124
53
71
108
102
104
103
79
94
51
59
87
105
133

	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]
[1,]	1452	4800	1728	6348	1875	2352	432	3888	4332	0	12	867
[2,]	4563	1587	5043	2523	192	363	75	8427	9075	867	675	0
[3,]	1728	4332	2028	5808	1587	2028	300	4332	4800	12	0	675
[4,]	1200	5292	1452	6912	2187	2700	588	3468	3888	12	48	1083
[5,]	972	5808	1200	7500	2523	3072	768	3072	3468	48	108	1323
[6,]	15552	300	16428	48	1875	1452	4332	22188	23232	7500	6912	3267
[7,]	3888	2028	4332	3072	363	588	12	7500	8112	588	432	27
[8,]	2523	3267	2883	4563	972	1323	75	5547	6075	147	75	300

```
 [9,] 15123   243 15987    27  1728  1323 4107 21675 22707  7203  6627  3072
[10,]   768 18252   588 21168 11907 13068 7500    12     0  4332  4800  9075
[11,]     3 11907     3 14283  6912  7803 3675   507   675  1587  1875  4800
[12,] 14700   192 15552    12  1587  1200 3888 21168 22188  6912  6348  2883
[13,] 12288    12 13068    48   867   588 2700 18252 19200  5292  4800  1875
[14,]  1083  5547  1323  7203  2352  2883  675  3267  3675    27    75  1200
[15,] 13872   108 14700     0  1323   972 3468 20172 21168  6348  5808  2523
[16,]  3468  2352  3888  3468   507   768    0  6912  7500   432   300    75
[17,]  7803   363  8427   867    48     3  867 12675 13467  2523  2187   432
[18,]  8112   300  8748   768    75    12  972 13068 13872  2700  2352   507
[19,]   507  7203   675  9075  3468  4107 1323  2187  2523   243   363  2028
[20,]   588 17328   432 20172 11163 12288 6912     0    12  3888  4332  8427
[21,]     0 11532    12 13872  6627  7500 3468   588   768  1452  1728  4563
[22,]  6627   675  7203  1323     0    27  507 11163 11907  1875  1587   192
[23,]  3267  2523  3675  3675   588   867    3  6627  7203   363   243   108
[24,]   243  8427   363 10443  4332  5043 1875  1587  1875   507   675  2700
[25,]   675  6627   867  8427  3072  3675 1083  2523  2883   147   243  1728
[26,] 11532     0 12288   108   675   432 2352 17328 18252  4800  4332  1587
[27,] 13872   108 14700     0  1323   972 3468 20172 21168  6348  5808  2523
[28,]  5808   972  6348  1728    27   108  300 10092 10800  1452  1200    75
[29,]  2352  3468  2700  4800  1083  1452  108  5292  5808   108    48   363
[30,]    12 12288     0 14700  7203  8112 3888   432   588  1728  2028  5043
[31,]  7500   432  8112   972    27     0  768 12288 13068  2352  2028   363
[32,]   300 15552   192 18252  9747 10800 5808    48   108  3072  3468  7203
[33,] 14283   147 15123     3  1452  1083 3675 20667 21675  6627  6075  2700
[34,]  1323  5043  1587  6627  2028  2523  507  3675  4107     3    27   972
     [,13] [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24]
 [1,]   243   363   108  6348  2523   507  7203  6627  1587  6912  2700   147
 [2,]  2028   108   363  2523   432  2700  3072  2700  4800  2883   507  1728
 [3,]   363   243    48  5808  2187   675  6627  6075  1875  6348  2352   243
 [4,]   147   507   192  6912  2883   363  7803  7203  1323  7500  3072    75
 [5,]    75   675   300  7500  3267   243  8427  7803  1083  8112  3468    27
 [6,] 10443  4563  5808    48  1323 11907     3    27 15987    12  1200  9747
 [7,]  1587    27   192  3072   675  2187  3675  3267  4107  3468   768  1323
 [8,]   768    48     3  4563  1452  1200  5292  4800  2700  5043  1587   588
 [9,] 10092  4332  5547    27  1200 11532     0    12 15552     3  1083  9408
[10,]  2523  7203  5808 21168 13467  1875 22707 21675   675 22188 13872  2883
[11,]   588  3468  2523 14283  8112   300 15552 14700     0 15123  8427   768
[12,]  9747  4107  5292    12  1083 11163     3     3 15123     0   972  9075
[13,]  7803  2883  3888    48   507  9075   147    75 12675   108   432  7203
[14,]   108   588   243  7203  3072   300  8112  7500  1200  7803  3267    48
[15,]  9075  3675  4800     0   867 10443    27     3 14283    12   768  8427
[16,]  1323     3   108  3468   867  1875  4107  3675  3675  3888   972  1083
[17,]  4332   972  1587   867     0  5292  1200   972  8112  1083     3  3888
[18,]  4563  1083  1728   768     3  5547  1083   867  8427   972     0  4107
[19,]     0  1200   675  9075  4332    48 10092  9408   588  9747  4563    12
```

```
[20,]  2187  6627  5292 20172 12675  1587 21675 20667   507 21168 13068  2523
[21,]   507  3267  2352 13872  7803   243 15123 14283     3 14700  8112   675
[22,]  3468   588  1083  1323    48  4332  1728  1452  6912  1587    75  3072
[23,]  1200     0    75  3675   972  1728  4332  3888  3468  4107  1083   972
[24,]    48  1728  1083 10443  5292     0 11532 10800   300 11163  5547   108
[25,]    12   972   507  8427  3888   108  9408  8748   768  9075  4107     0
[26,]  7203  2523  3468   108   363  8427   243   147 11907   192   300  6627
[27,]  9075  3675  4800     0   867 10443    27     3 14283    12   768  8427
[28,]  2883   363   768  1728   147  3675  2187  1875  6075  2028   192  2523
[29,]   675    75     0  4800  1587  1083  5547  5043  2523  5292  1728   507
[30,]   675  3675  2700 14700  8427   363 15987 15123     3 15552  8748   867
[31,]  4107   867  1452   972     3  5043  1323  1083  7803  1200    12  3675
[32,]  1587  5547  4332 18252 11163  1083 19683 18723   243 19200 11532  1875
[33,]  9408  3888  5043     3   972 10800    12     0 14700     3   867  8748
[34,]   192   432   147  6627  2700   432  7500  6912  1452  7203  2883   108
     [,25] [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34]
 [1,]    3    27    12  1452   147  7500  5292   588    48  3072
 [2,]   972  1200  1083    75   300  3267  1875    27  1323  7203
 [3,]    27    75    48  1200    75  6912  4800   432   108  3468
 [4,]     3     3     0  1728   243  8112  5808   768    12  2700
 [5,]    27     3    12  2028   363  8748  6348   972     0  2352
 [6,]  7803  8427  8112  2352  5547     0   192  3888  8748 20172
 [7,]   675   867   768   192   147  3888  2352     0   972  6348
 [8,]   192   300   243   675     0  5547  3675   147   363  4563
 [9,]  7500  8112  7803  2187  5292     3   147  3675  8427 19683
[10,]  4107  3675  3888 10800  6075 23232 19200  8112  3468   108
[11,]  1452  1200  1323  6075  2700 15987 12675  4107  1083   243
[12,]  7203  7803  7500  2028  5043    12   108  3468  8112 19200
[13,]  5547  6075  5808  1200  3675   192     0  2352  6348 16428
[14,]    12     0     3  1875   300  8427  6075   867     3  2523
[15,]  6627  7203  6912  1728  4563    48    48  3072  7500 18252
[16,]   507   675   588   300    75  4332  2700    12   768  5808
[17,]  2700  3072  2883   147  1452  1323   507   675  3267 11163
[18,]  2883  3267  3072   192  1587  1200   432   768  3468 11532
[19,]   192   108   147  2883   768 10443  7803  1587    75  1587
[20,]  3675  3267  3468 10092  5547 22188 18252  7500  3072    48
[21,]  1323  1083  1200  5808  2523 15552 12288  3888   972   300
[22,]  2028  2352  2187    27   972  1875   867   363  2523  9747
[23,]   432   588   507   363    48  4563  2883    27   675  5547
[24,]   432   300   363  3675  1200 11907  9075  2187   243  1083
[25,]   108    48    75  2523   588  9747  7203  1323    27  1875
[26,]  5043  5547  5292   972  3267   300    12  2028  5808 15552
[27,]  6627  7203  6912  1728  4563    48    48  3072  7500 18252
[28,]  1587  1875  1728     0   675  2352  1200   192  2028  8748
[29,]   147   243   192   768     3  5808  3888   192   300  4332
[30,]  1587  1323  1452  6348  2883 16428 13068  4332  1200   192
```

```
[31,]  2523  2883  2700   108  1323  1452   588   588  3072 10800
[32,]  2883  2523  2700  8748  4563 20172 16428  6348  2352     0
[33,]  6912  7500  7203  1875  4800    27    75  3267  7803 18723
[34,]     0    12     3  1587   192  7803  5547   675    27  2883
16/02/23 12:50:17 INFO SparkContext: Invoking stop() from shutdown hook
16/02/23 12:50:17 INFO SparkUI: Stopped Spark web UI at
http://10.151.4.221:4040
16/02/23 12:50:17 INFO MapOutputTrackerMasterEndpoint:
MapOutputTrackerMasterEndpoint stopped!
16/02/23 12:50:17 INFO MemoryStore: MemoryStore cleared
16/02/23 12:50:17 INFO BlockManager: BlockManager stopped
16/02/23 12:50:17 INFO BlockManagerMaster: BlockManagerMaster stopped
16/02/23 12:50:17 INFO
OutputCommitCoordinator$OutputCommitCoordinatorEndpoint:
OutputCommitCoordinator stopped!
16/02/23 12:50:17 INFO SparkContext: Successfully stopped SparkContext
16/02/23 12:50:17 INFO ShutdownHookManager: Shutdown hook called
16/02/23 12:50:17 INFO ShutdownHookManager: Deleting directory
/private/var/folders/qk/1jbpq9p52n9004zj72d6bz6r0000gn/T/spark-5e8ae920-7ec5-
4590-b2a6-10ca630ca1f0
weis-mbp:bin whng2$
```