MPI Application Report

localhost:6419

report.md

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Introduction

In this project, first of all, I needed some research about open-mpi since I don't have any experience about parallel programming. I had to get used to `malloc` and `calloc`. At the end of the day my code works exactly the way described in the project text. It lists P similar words, each from one processor, again and again until the command **EXIT** is given as a query. When it is given, the code ends the session and terminates itself. Before I started to implement the *bonus part*, I saved my working code as `yedek.c` which you can find in my submission.

After that, all my work is on the other code, `kod.c`. This one also works fine. It correctly calculates the similarities and lists the **most** similar P words, as described in the *bonus part*. However, unlike the other one, this one does not have an infinite session. After answering the first query, correctly finding and listing the P **most** similar words with their similarity scores, somehow, it terminates itself with an error. I couldn't solve it since I got tons of stuff to do , and unfortunately, I had to submit it as it is. Maybe the problem was about my computer, production environment or the operating system; so **please try `kod.c` on your local machine**.

The source code we covered at PS was very useful for me, it made everything a bit easier. The main structures of my, both, codes is the same of the example code given, since I worked on it. I modified and expanded it for this project.

In this report I'm going to focus on the main modifications and implementations, which does not exist in the example code, of my source code; i.e main differences between my source code and the example one. Throughout the report, you will see a lot of parts from my code with explanations. Also, you can find **lots of comments** in the codes if you want to check out. The codes actually document and report themselves.

`void distributeEmbeddings(char *filename, int p)`

- My distributeEmbeddings function is very similar to the one in the source code we covered at PS. I added one more parameter, `int p` because I need the processor number in the function.

- Additionally, I put it in a larger loop scope, `for (int i = 1; i < p; i++) {` because I needed to distribute the input to the processors equally. But unlikely, the example code just sends the `words` and `embeddings_matrix` to only one. So I solved this difference with this modification.

- The problem I encountered while implementing this function was `strcpy`. Somehow, `strcpy` didn't work the way it's meant to work. So I solved this problem by implementing my own `strcpy` manually, which you can see below.

```
int len = 0;
while (*(word+len) != '\0'){
 *(words+j*MAX_WORD_LEN+len) = *(word+len);
 len++;
}
for (int k=len;k<MAX_WORD_LEN;k++)
 *(words+j*MAX_WORD_LEN+k) = NULL;
```

int findWordIndex(char *words, char *query_word)

This function is totally the same as the example code given. I modified it for only coding style. The functionality is the same as the given.

void runMasterNode(int world_rank, int p)

- Differently from the example code, I took one more parameter here. `int p` is the number of processors.
- After calling `distributeEmbeddings` and entering into the loop `while(1==1)` like the example code, this function sends commands to the slave nodes.
- Command here is, 0 if 'EXIT' is given, 1 otherwise. If the command is 1, then it sends the query to each slave node and waits for receiving the answer.
- The answer here, is the index of the query word. If a slave node finds the query word in its word pool, it returns the index, -1 otherwise. I designed this part like this because **the master has to know, if any of the processors have the query word**.
- If no processor finds the query word in its scope, then no output is printed. If one of the slave nodes finds the query word, then the variable `command` becomes 2, which means **CALCULATE_SIMILARITY**.

```
if(index != -1){
     command = COMMAND_CALCULATE_SIMILARITY;
```

After this, MASTER sends commands each one of the slaves to calculate similarity by:

```
for (int i=1;i<p;i++) {
    MPI_Send(
      /* data         = */ &command,
      /* count        = */ 1,
      /* datatype     = */ MPI_INT,
      /* destination  = */ i,
      /* tag          = */ 0,
      /* communicator = */ MPI_COMM_WORLD);
  }
```

- After that, MASTER receives the **most similar P words and their scores** from **each of the P slaves**. For the example given in the project description, right now we have 100 words at MASTER, the most similar 10 from each of the 10 slaves.
- After receiving the words and the scores, MASTER writes them on its own arrays.
- Here I put the whole receiving part since it's a very important part of the MASTER function, for the bonus part.

```
// We need to get P-1 words with their scores from each of the P-1 processors.
for (int i=1;i<p;i++){
   for(int k=1;k<p;k++){
    // Recieving the words ont by one from the slave i.
     MPI_Recv(
          /* data         = */ word,
          /* count        = */ MAX_WORD_LEN,
          /* datatype     = */ MPI_CHAR,
          /* source       = */ i,
          /* tag          = */ 0,
          /* communicator = */ MPI_COMM_WORLD,
          /* status       = */ MPI_STATUS_IGNORE);
     // Recieving the similarity score for the corresponding word.
     MPI_Recv(
          /* data         = */ &similarityScore,
          /* count        = */ 1,
          /* datatype     = */ MPI_FLOAT,
          /* source       = */ i,
          /* tag          = */ 0,
          /* communicator = */ MPI_COMM_WORLD,
          /* status       = */ MPI_STATUS_IGNORE);

     for (int j = 0; j < MAX_WORD_LEN; ++j) {
          words[((i-1)*(p-1)+k-1)*MAX_WORD_LEN+j] = word[j];
     }
      similarityScores[(i-1)*(p-1)+k-1] = similarityScore;
   }
}
```

- After receiving the P*P similar words, MASTER finds the most similar P. In our example in the project description, MASTER finds 10 out of 100 words.
- Here in order to find the P words with the biggest scores, I preferred to iterate those P*P words P times; instead of sorting them.
- For that, I needed `int* used = (int*)calloc((p-1)*(p-1), sizeof(int));` This array holds 0 if the word with the corresponding index is not used, i.e not printed as output,

while it holds 1 if the word with the corresponding index is used, i.e printed as output.

- In each iteration it checks `if( (*(used+i))!=1 && *(similarityScores+i) > maxScore)` for every word that MASTER got. This way it founds **a non-used word with the maximum similarity score**.
- Of course, after each iteration, the word found is marked as used, in order not to find it again as maximum. `*(used+maxIndex) = 1;`
- In each iteration it prints one word and after P iterations, the most similar P words are being listed in the order of descending scores.

`void runSlaveNode(int world_rank, int p)`

- Again, differently from the example code, I took one more parameter here. `int p` is the number of processors.
- Like the same function of the example code, firstly it receives `words` and `embeddings_matrix`
- After beginning to loop `while(1==1){` , it receives a `command` from the MASTER.
- If the command is EXIT, the slave frees the arrays it took, then returns.

```
int command;
MPI_Recv(
    /* data         = */ &command,
    /* count        = */ 1,
    /* datatype     = */ MPI_INT,
    /* source       = */ 0,
    /* tag          = */ 0,
    /* communicator = */ MPI_COMM_WORLD,
    /* status       = */ MPI_STATUS_IGNORE);
//printf("Command received:%d by process %d\n",command, world_rank);
// If the EXIT COMMAND is recieved, free the memory we got, terminate the slave and return.
if(command == COMMAND_EXIT){
     free(words);
     free(embeddings_matrix);
     return;
}
```

- If the command received is not `COMMAND_QUERY` , which is 1, then the loop finishes there. Slave starts to wait for a new command. If it is 1, then it continues, receives the query etc.
- After receiving the query word, slave tries to find it amongst the words. To do that, it calls the `findWordIndex` function as `int wordIndex = findWordIndex(words, query_word);`
- Here `wordIndex` holds the index of `query_word` in `words` . Holds -1 if it is not found. Actually it's mostly -1 because for each query, maximum 1 slave can find it.
- After finding the word index, or -1, the slave sends it to the MASTER.
- Slave starts to wait for receiving a new command from the MASTER, which will be `CALCULATE_SIMILARITY` , means 2, if calculating the similarities is necessary.
- If the new command comes as 0 or 1, the loop ends there and no calculations will

be made. In the big picture, the design of the algorithm, in means **there is no such word**. If the query word is not found in our word pool, then no calculations will be made.

- If the slave receives a calculation command, it calculates the similarity for each word.

```
for(int embIndex = 0; embIndex<EMBEDDING_DIMENSION; embIndex++)
  similarity+=(taken_matrix[embIndex]*(*
(embeddings_matrix+wordIndex*EMBEDDING_DIMENSION+embIndex)));
```

- If the calculated similarity is enough big to be in the **list of first P words**, it takes the place of the last element of this list. Then the slave starts to **push the new word through the front as much as possible while its score is bigger than the next word's score**.
- Since this is a very important part for the bonus part, I put the *updating the list* part here.

```
// If the similarity score is bigger than the last(the smallest) member of the list of biggest elements,
// it means we need to remove the last one, put the new one.
if(similarity > *(topScores+p-2)){
    *(similarWordIndexes+p-2) = wordIndex;
    *(topScores+p-2) = similarity;
    // Pushing the new element to the front as much as possible.
    for(int i=p-2;i>0;i--){
  if(*(topScores+i-1) > *(topScores+i))
          break;
  // Swapping the elements in topScores
      float tmpf = *(topScores+i-1);
      *(topScores+i-1) = *(topScores+i);
      *(topScores+i) = tmpf;
      // Swapping the elements in similarWordIndexes
      int tmpi = *(similarWordIndexes+i-1);
      *(similarWordIndexes+i-1) = *(similarWordIndexes+i);
      *(similarWordIndexes+i) = tmpi;
    }
}
```

- After all the iterations are finished, the slave has the **most similar P words with their scores**.
- Then the slave sends the MASTER the most similar P words with their scores.
- Since it would be more simple to implement for me, the slave sends all them one by one, NOT as an array.

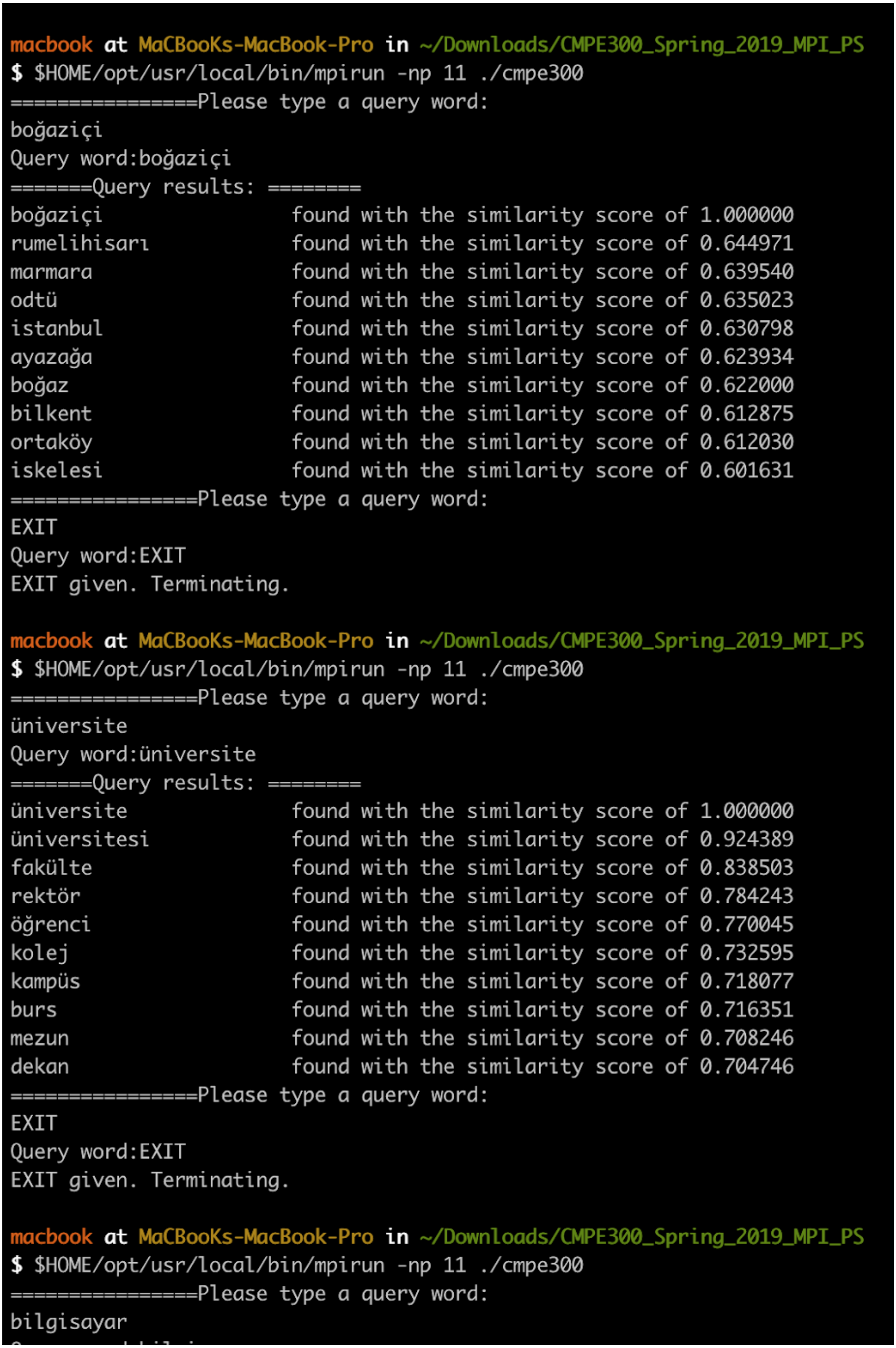
`int main(int argc, char** argv)`

It's the same as in the source code we covered at PS.

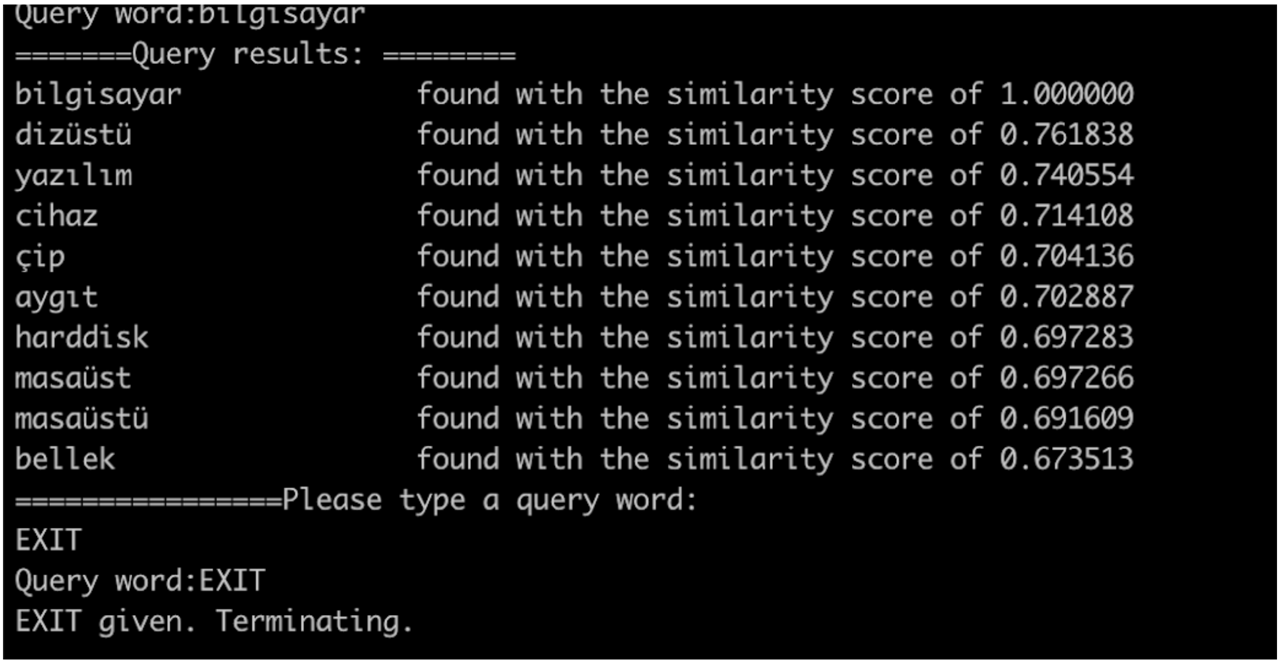
Expected Outputs

Includes the outputs of both `kod.c` and `yedek.c`

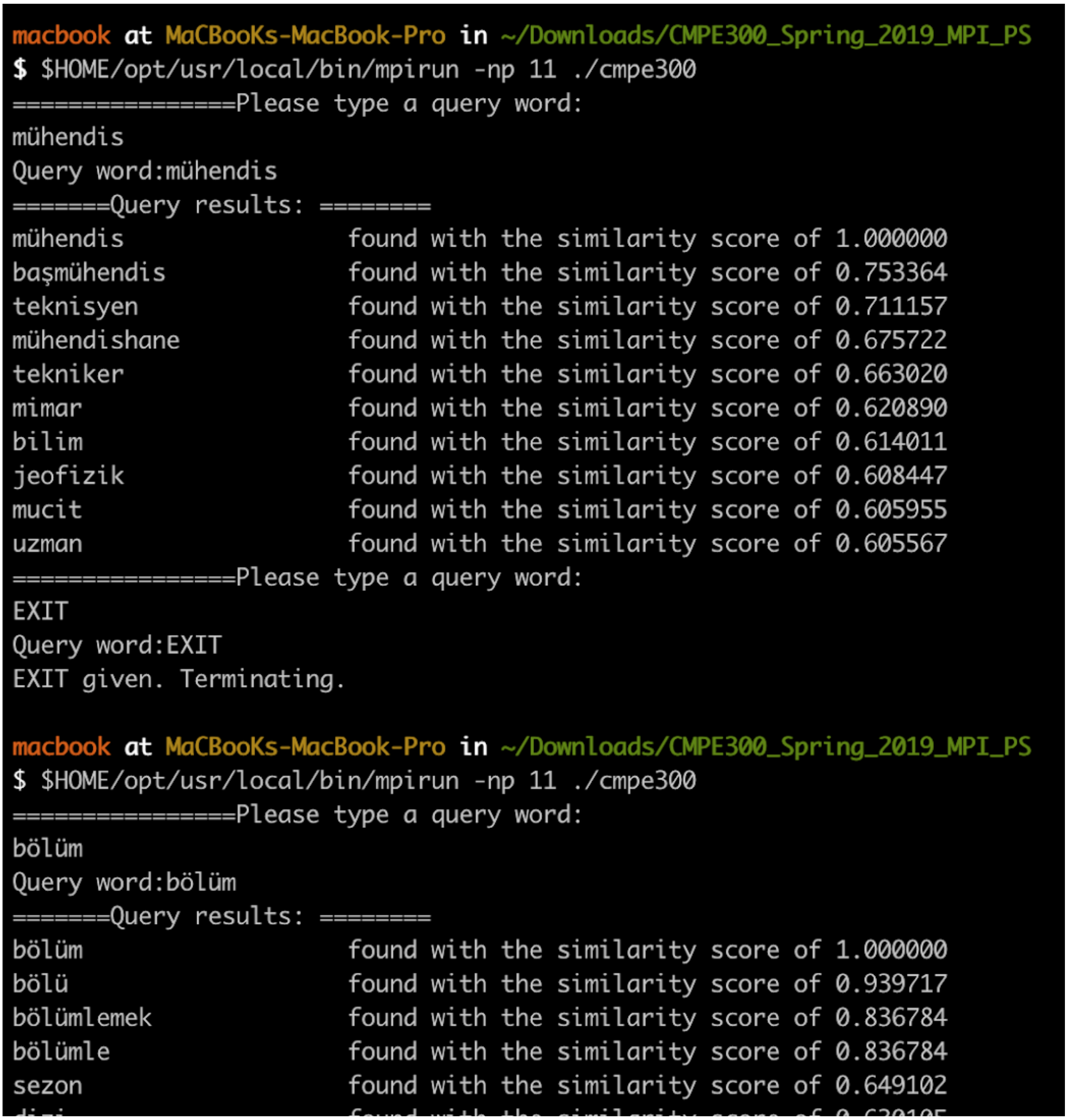
The outputs of `kod.c` with the bonus part



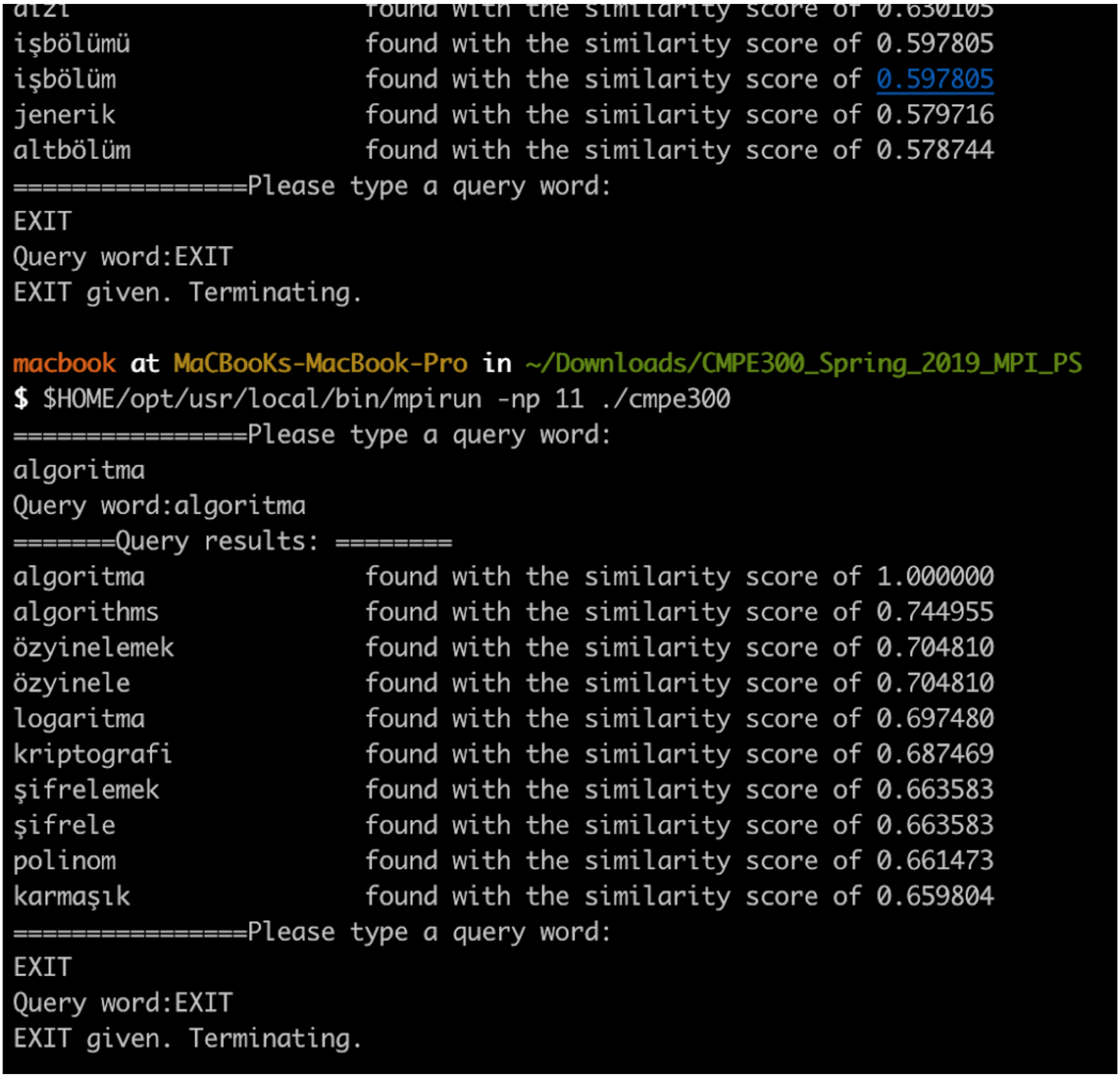
```
macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
boğaziçi
Query word:boğaziçi
=======Query results: ========
boğaziçi                found with the similarity score of 1.000000
rumelihisarı            found with the similarity score of 0.644971
marmara                 found with the similarity score of 0.639540
odtü                    found with the similarity score of 0.635023
istanbul                found with the similarity score of 0.630798
ayazağa                 found with the similarity score of 0.623934
boğaz                   found with the similarity score of 0.622000
bilkent                 found with the similarity score of 0.612875
ortaköy                 found with the similarity score of 0.612030
iskelesi                found with the similarity score of 0.601631
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
üniversite
Query word:üniversite
=======Query results: ========
üniversite              found with the similarity score of 1.000000
üniversitesi            found with the similarity score of 0.924389
fakülte                 found with the similarity score of 0.838503
rektör                  found with the similarity score of 0.784243
öğrenci                 found with the similarity score of 0.770045
kolej                   found with the similarity score of 0.732595
kampüs                  found with the similarity score of 0.718077
burs                    found with the similarity score of 0.716351
mezun                   found with the similarity score of 0.708246
dekan                   found with the similarity score of 0.704746
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
bilgisayar
```



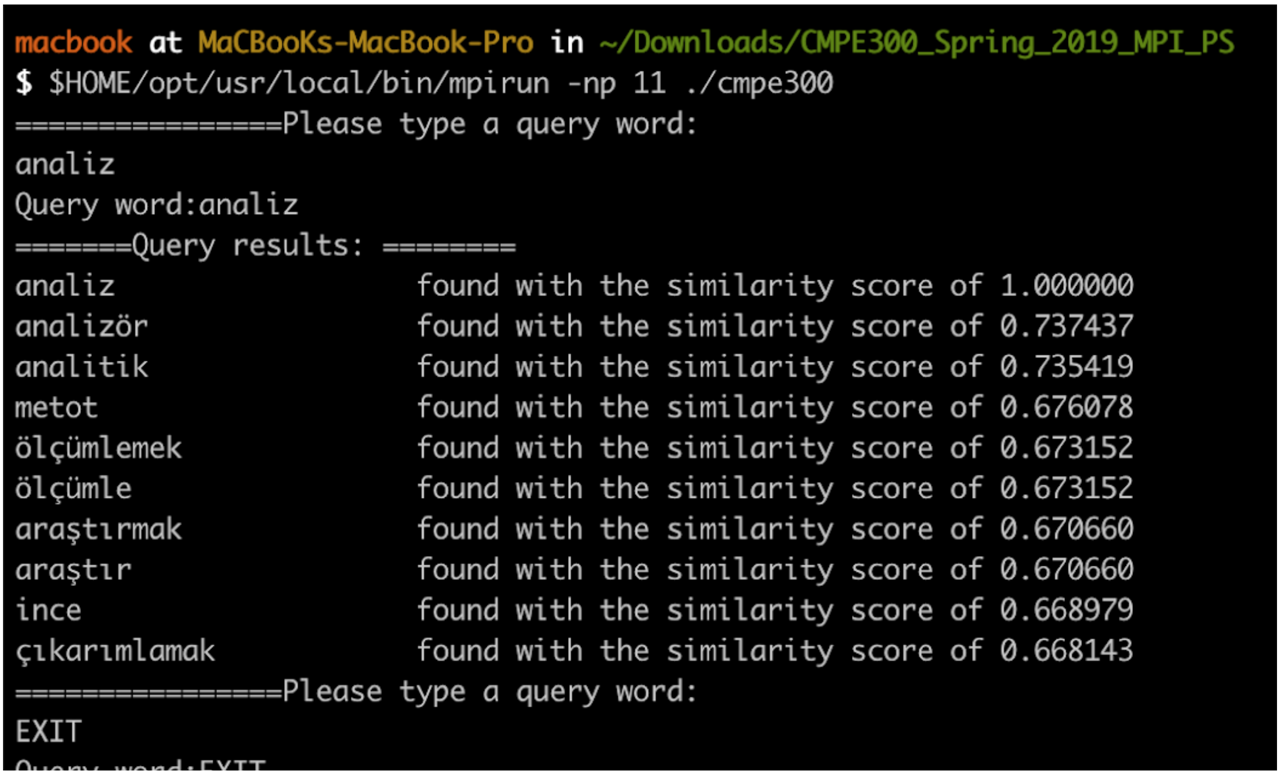
```
Query word:bilgisayar
=======Query results: ========
bilgisayar               found with the similarity score of 1.000000
dizüstü                  found with the similarity score of 0.761838
yazılım                  found with the similarity score of 0.740554
cihaz                    found with the similarity score of 0.714108
çip                      found with the similarity score of 0.704136
aygıt                    found with the similarity score of 0.702887
harddisk                 found with the similarity score of 0.697283
masaüst                  found with the similarity score of 0.697266
masaüstü                 found with the similarity score of 0.691609
bellek                   found with the similarity score of 0.673513
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.
```



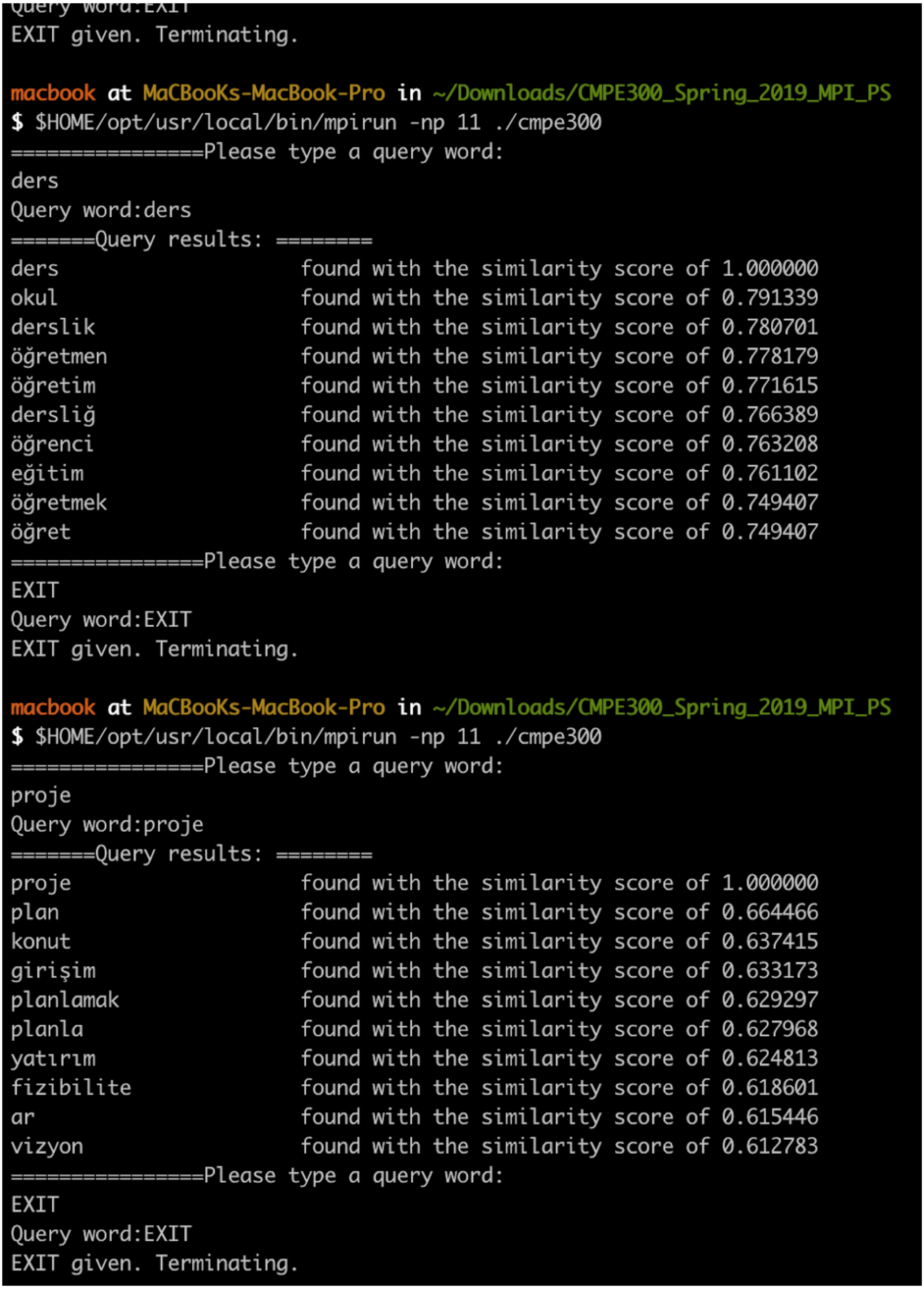
```
macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
mühendis
Query word:mühendis
=======Query results: ========
mühendis                 found with the similarity score of 1.000000
başmühendis              found with the similarity score of 0.753364
teknisyen                found with the similarity score of 0.711157
mühendishane             found with the similarity score of 0.675722
tekniker                 found with the similarity score of 0.663020
mimar                    found with the similarity score of 0.620890
bilim                    found with the similarity score of 0.614011
jeofizik                 found with the similarity score of 0.608447
mucit                    found with the similarity score of 0.605955
uzman                    found with the similarity score of 0.605567
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
bölüm
Query word:bölüm
=======Query results: ========
bölüm                    found with the similarity score of 1.000000
bölü                     found with the similarity score of 0.939717
bölümlemek               found with the similarity score of 0.836784
bölümle                  found with the similarity score of 0.836784
sezon                    found with the similarity score of 0.649102
dizi                     found with the similarity score of 0.630105
```



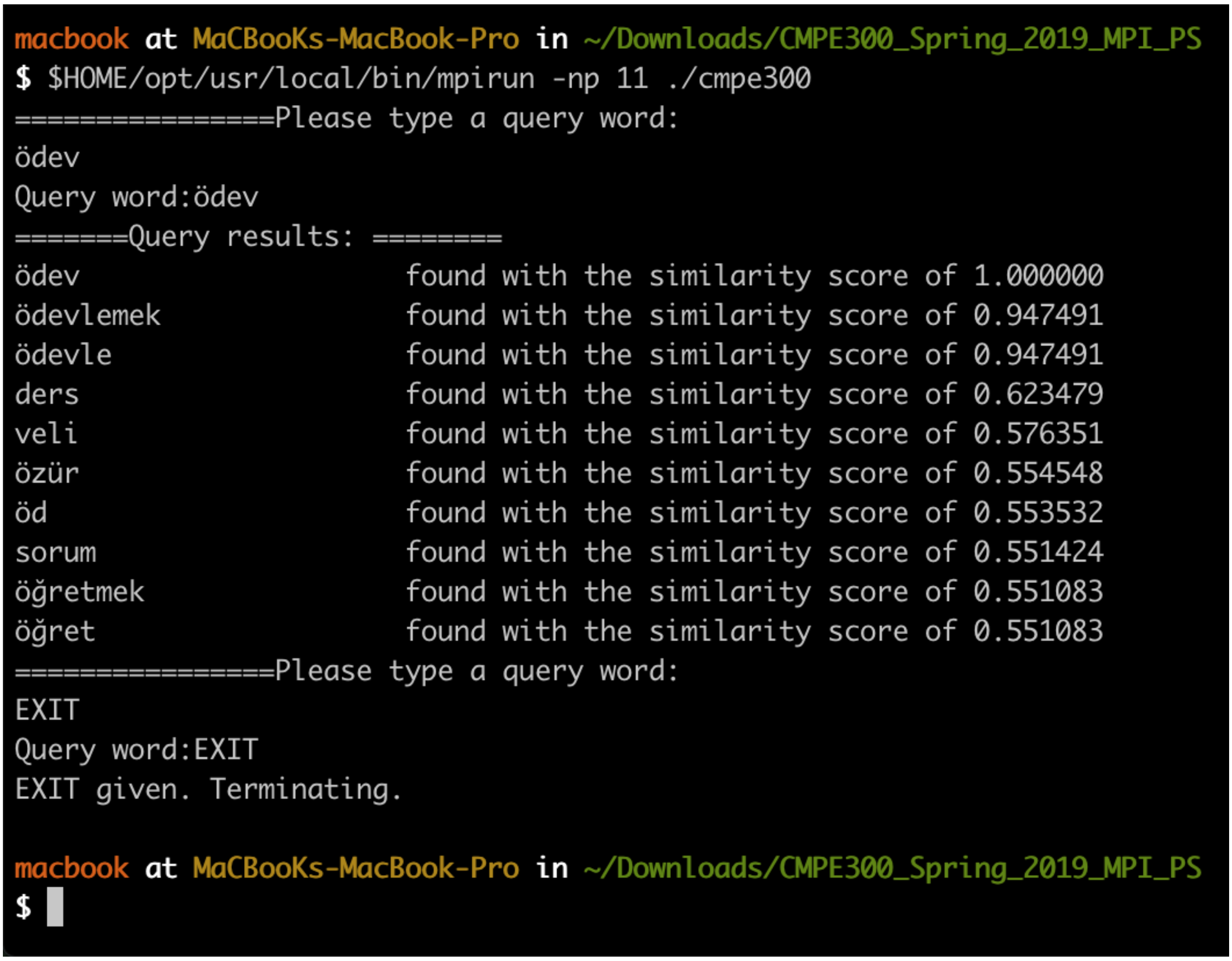
```
dizi                    found with the similarity score of 0.630105
işbölümü                found with the similarity score of 0.597805
işbölüm                 found with the similarity score of 0.597805
jenerik                 found with the similarity score of 0.579716
altbölüm                found with the similarity score of 0.578744
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
algoritma
Query word:algoritma
=======Query results: ========
algoritma               found with the similarity score of 1.000000
algorithms              found with the similarity score of 0.744955
özyinelemek             found with the similarity score of 0.704810
özyinele                found with the similarity score of 0.704810
logaritma               found with the similarity score of 0.697480
kriptografi             found with the similarity score of 0.687469
şifrelemek              found with the similarity score of 0.663583
şifrele                 found with the similarity score of 0.663583
polinom                 found with the similarity score of 0.661473
karmaşık                found with the similarity score of 0.659804
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.
```



```
macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
analiz
Query word:analiz
=======Query results: ========
analiz                  found with the similarity score of 1.000000
analizör                found with the similarity score of 0.737437
analitik                found with the similarity score of 0.735419
metot                   found with the similarity score of 0.676078
ölçümlemek              found with the similarity score of 0.673152
ölçümle                 found with the similarity score of 0.673152
araştırmak              found with the similarity score of 0.670660
araştır                 found with the similarity score of 0.670660
ince                    found with the similarity score of 0.668979
çıkarımlamak            found with the similarity score of 0.668143
================Please type a query word:
EXIT
Query word:EXIT
```

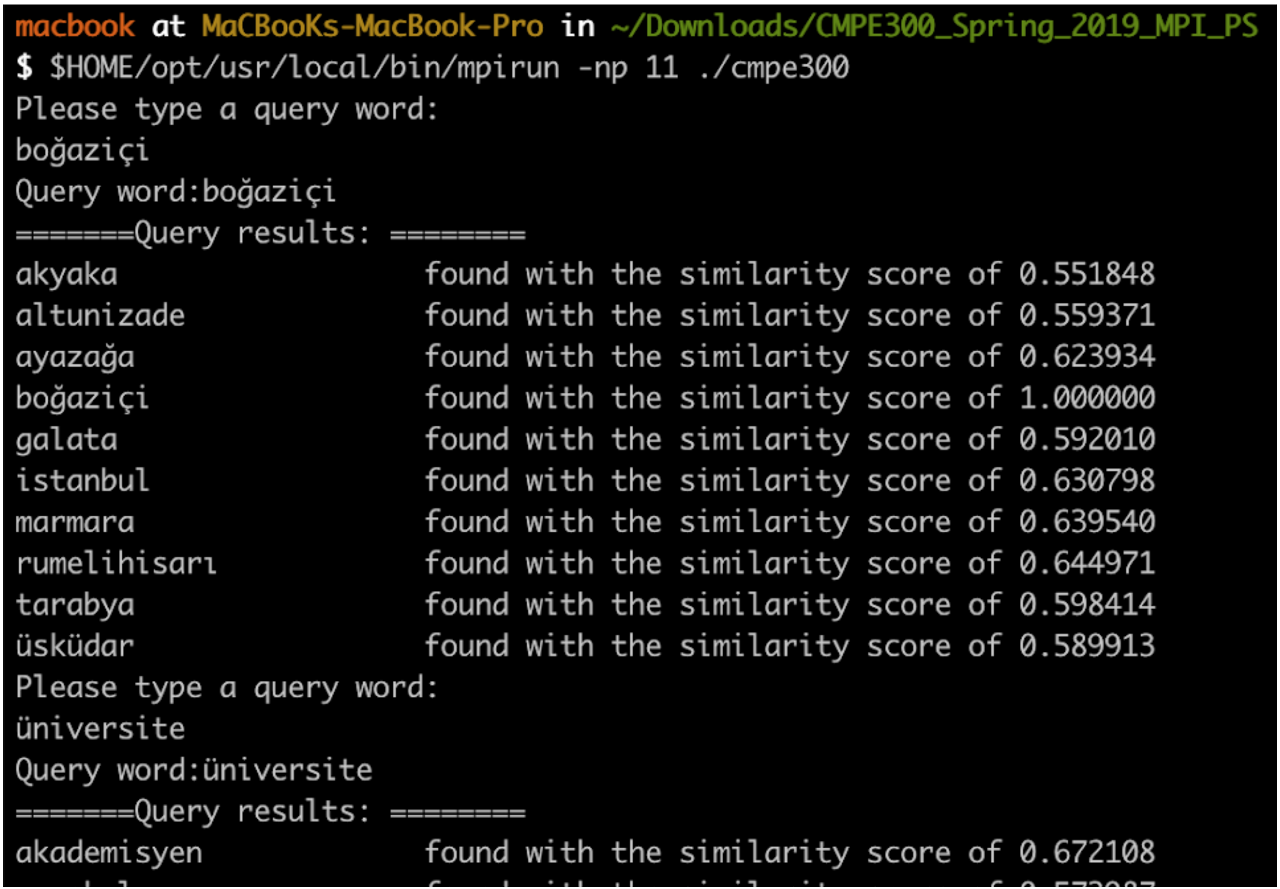


```
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
ders
Query word:ders
=======Query results: ========
ders                    found with the similarity score of 1.000000
okul                    found with the similarity score of 0.791339
derslik                 found with the similarity score of 0.780701
öğretmen                found with the similarity score of 0.778179
öğretim                 found with the similarity score of 0.771615
dersliğ                 found with the similarity score of 0.766389
öğrenci                 found with the similarity score of 0.763208
eğitim                  found with the similarity score of 0.761102
öğretmek                found with the similarity score of 0.749407
öğret                   found with the similarity score of 0.749407
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
proje
Query word:proje
=======Query results: ========
proje                   found with the similarity score of 1.000000
plan                    found with the similarity score of 0.664466
konut                   found with the similarity score of 0.637415
girişim                 found with the similarity score of 0.633173
planlamak               found with the similarity score of 0.629297
planla                  found with the similarity score of 0.627968
yatırım                 found with the similarity score of 0.624813
fizibilite              found with the similarity score of 0.618601
ar                      found with the similarity score of 0.615446
vizyon                  found with the similarity score of 0.612783
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.
```

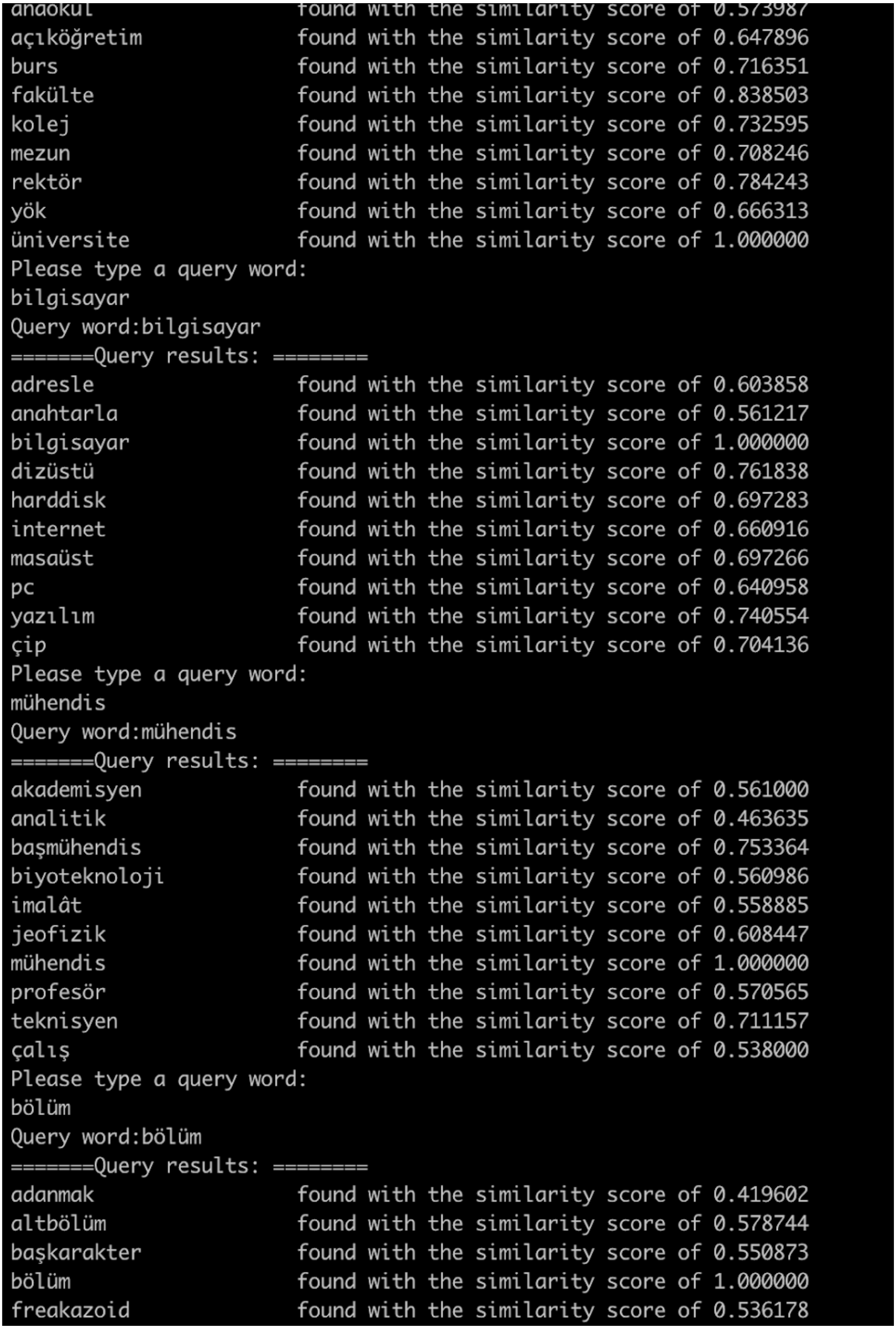


```
macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
================Please type a query word:
ödev
Query word:ödev
=======Query results: ========
ödev                        found with the similarity score of 1.000000
ödevlemek                   found with the similarity score of 0.947491
ödevle                      found with the similarity score of 0.947491
ders                        found with the similarity score of 0.623479
veli                        found with the similarity score of 0.576351
özür                        found with the similarity score of 0.554548
öd                          found with the similarity score of 0.553532
sorum                       found with the similarity score of 0.551424
öğretmek                    found with the similarity score of 0.551083
öğret                       found with the similarity score of 0.551083
================Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ 
```

The outputs of `yedek.c` without the bonus part

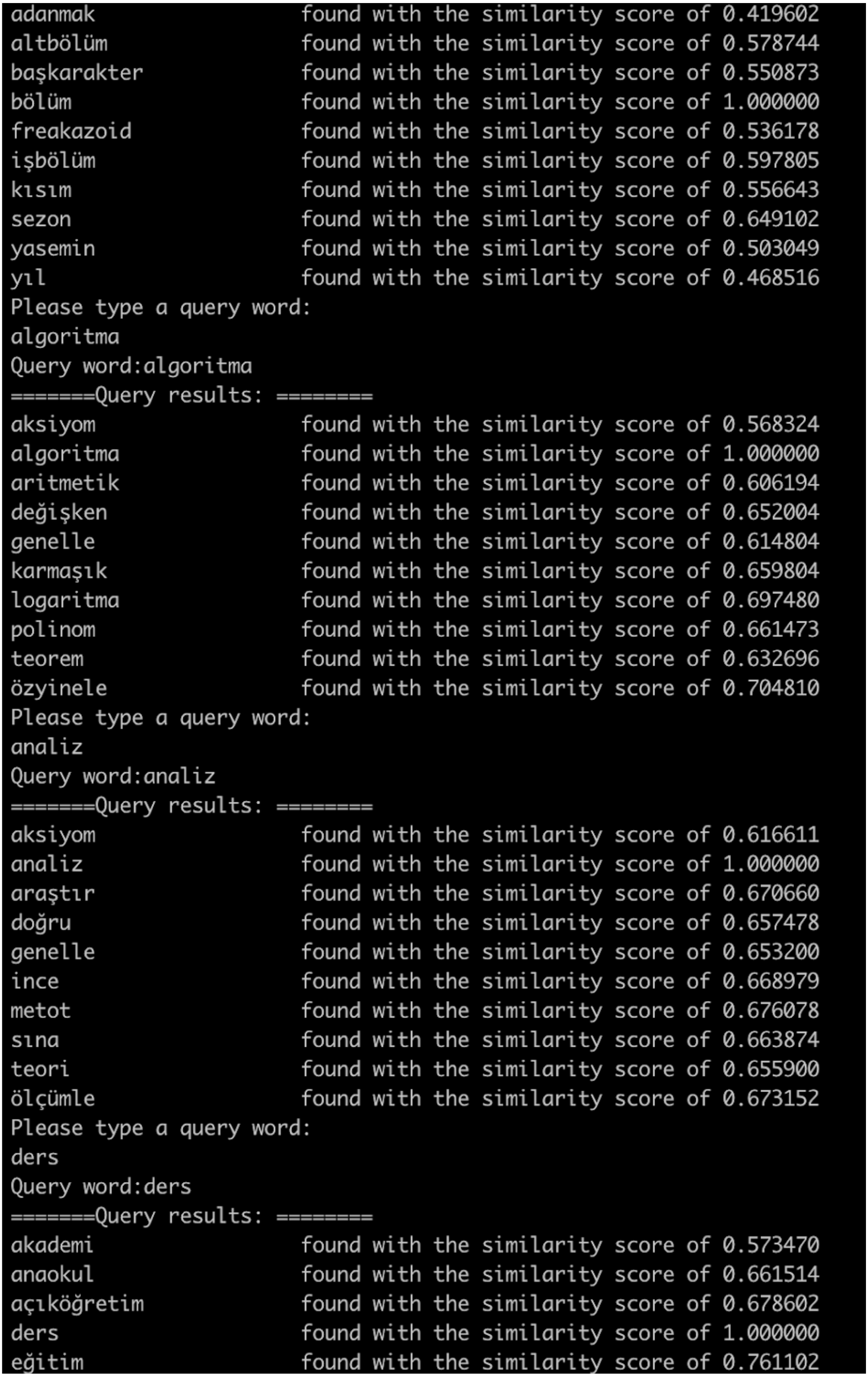


```
macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI_PS
$ $HOME/opt/usr/local/bin/mpirun -np 11 ./cmpe300
Please type a query word:
boğaziçi
Query word:boğaziçi
=======Query results: ========
akyaka                      found with the similarity score of 0.551848
altunizade                  found with the similarity score of 0.559371
ayazağa                     found with the similarity score of 0.623934
boğaziçi                    found with the similarity score of 1.000000
galata                      found with the similarity score of 0.592010
istanbul                    found with the similarity score of 0.630798
marmara                     found with the similarity score of 0.639540
rumelihisarı                found with the similarity score of 0.644971
tarabya                     found with the similarity score of 0.598414
üsküdar                     found with the similarity score of 0.589913
Please type a query word:
üniversite
Query word:üniversite
=======Query results: ========
akademisyen                 found with the similarity score of 0.672108
```

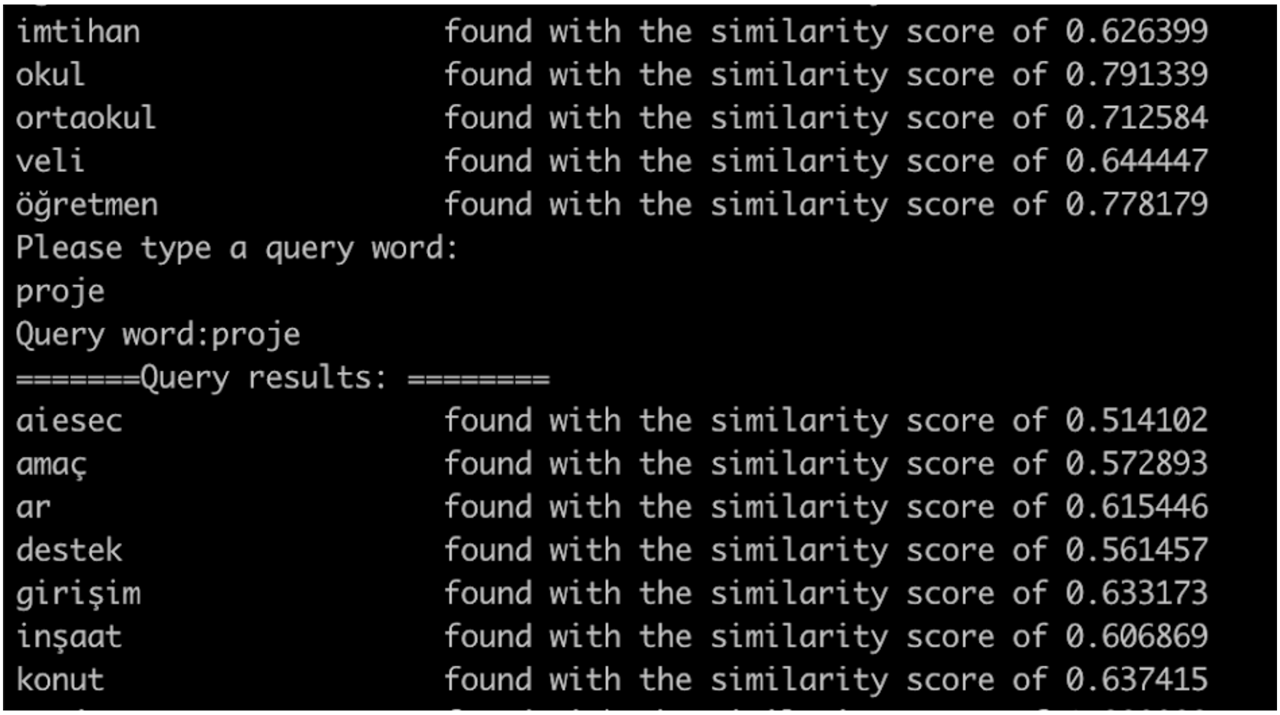


```
anaokul                 found with the similarity score of 0.573987
açıköğretim             found with the similarity score of 0.647896
burs                    found with the similarity score of 0.716351
fakülte                 found with the similarity score of 0.838503
kolej                   found with the similarity score of 0.732595
mezun                   found with the similarity score of 0.708246
rektör                  found with the similarity score of 0.784243
yök                     found with the similarity score of 0.666313
üniversite              found with the similarity score of 1.000000
Please type a query word:
bilgisayar
Query word:bilgisayar
=======Query results: ========
adresle                 found with the similarity score of 0.603858
anahtarla               found with the similarity score of 0.561217
bilgisayar              found with the similarity score of 1.000000
dizüstü                 found with the similarity score of 0.761838
harddisk                found with the similarity score of 0.697283
internet                found with the similarity score of 0.660916
masaüst                 found with the similarity score of 0.697266
pc                      found with the similarity score of 0.640958
yazılım                 found with the similarity score of 0.740554
çip                     found with the similarity score of 0.704136
Please type a query word:
mühendis
Query word:mühendis
=======Query results: ========
akademisyen             found with the similarity score of 0.561000
analitik                found with the similarity score of 0.463635
başmühendis             found with the similarity score of 0.753364
biyoteknoloji           found with the similarity score of 0.560986
imalât                  found with the similarity score of 0.558885
jeofizik                found with the similarity score of 0.608447
mühendis                found with the similarity score of 1.000000
profesör                found with the similarity score of 0.570565
teknisyen               found with the similarity score of 0.711157
çalış                   found with the similarity score of 0.538000
Please type a query word:
bölüm
Query word:bölüm
=======Query results: ========
adanmak                 found with the similarity score of 0.419602
altbölüm                found with the similarity score of 0.578744
başkarakter             found with the similarity score of 0.550873
bölüm                   found with the similarity score of 1.000000
freakazoid              found with the similarity score of 0.536178
```

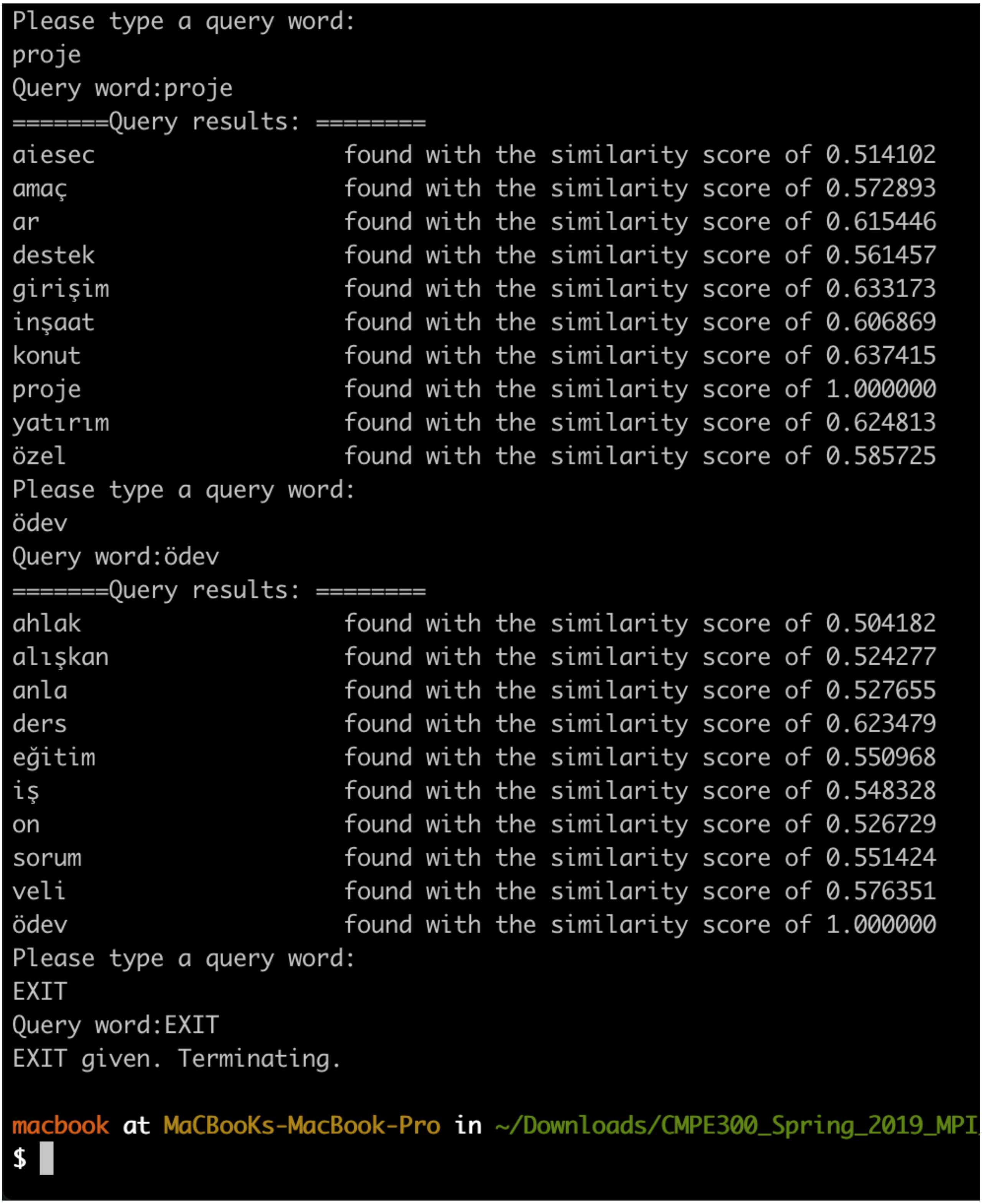
```
Query word:bölüm
=======Query results: ========
```



```
adanmak                 found with the similarity score of 0.419602
altbölüm                found with the similarity score of 0.578744
başkarakter             found with the similarity score of 0.550873
bölüm                   found with the similarity score of 1.000000
freakazoid              found with the similarity score of 0.536178
işbölüm                 found with the similarity score of 0.597805
kısım                   found with the similarity score of 0.556643
sezon                   found with the similarity score of 0.649102
yasemin                 found with the similarity score of 0.503049
yıl                     found with the similarity score of 0.468516
Please type a query word:
algoritma
Query word:algoritma
=======Query results: ========
aksiyom                 found with the similarity score of 0.568324
algoritma               found with the similarity score of 1.000000
aritmetik               found with the similarity score of 0.606194
değişken                found with the similarity score of 0.652004
genelle                 found with the similarity score of 0.614804
karmaşık                found with the similarity score of 0.659804
logaritma               found with the similarity score of 0.697480
polinom                 found with the similarity score of 0.661473
teorem                  found with the similarity score of 0.632696
özyinele                found with the similarity score of 0.704810
Please type a query word:
analiz
Query word:analiz
=======Query results: ========
aksiyom                 found with the similarity score of 0.616611
analiz                  found with the similarity score of 1.000000
araştır                 found with the similarity score of 0.670660
doğru                   found with the similarity score of 0.657478
genelle                 found with the similarity score of 0.653200
ince                    found with the similarity score of 0.668979
metot                   found with the similarity score of 0.676078
sına                    found with the similarity score of 0.663874
teori                   found with the similarity score of 0.655900
ölçümle                 found with the similarity score of 0.673152
Please type a query word:
ders
Query word:ders
=======Query results: ========
akademi                 found with the similarity score of 0.573470
anaokul                 found with the similarity score of 0.661514
açıköğretim             found with the similarity score of 0.678602
ders                    found with the similarity score of 1.000000
eğitim                  found with the similarity score of 0.761102
```



```
imtihan                  found with the similarity score of 0.626399
okul                     found with the similarity score of 0.791339
ortaokul                 found with the similarity score of 0.712584
veli                     found with the similarity score of 0.644447
öğretmen                 found with the similarity score of 0.778179
Please type a query word:
proje
Query word:proje
=======Query results: ========
aiesec                   found with the similarity score of 0.514102
amaç                     found with the similarity score of 0.572893
ar                       found with the similarity score of 0.615446
destek                   found with the similarity score of 0.561457
girişim                  found with the similarity score of 0.633173
inşaat                   found with the similarity score of 0.606869
konut                    found with the similarity score of 0.637415
```



```
Please type a query word:
proje
Query word:proje
=======Query results: ========
aiesec                  found with the similarity score of 0.514102
amaç                    found with the similarity score of 0.572893
ar                      found with the similarity score of 0.615446
destek                  found with the similarity score of 0.561457
girişim                 found with the similarity score of 0.633173
inşaat                  found with the similarity score of 0.606869
konut                   found with the similarity score of 0.637415
proje                   found with the similarity score of 1.000000
yatırım                 found with the similarity score of 0.624813
özel                    found with the similarity score of 0.585725
Please type a query word:
ödev
Query word:ödev
=======Query results: ========
ahlak                   found with the similarity score of 0.504182
alışkan                 found with the similarity score of 0.524277
anla                    found with the similarity score of 0.527655
ders                    found with the similarity score of 0.623479
eğitim                  found with the similarity score of 0.550968
iş                      found with the similarity score of 0.548328
on                      found with the similarity score of 0.526729
sorum                   found with the similarity score of 0.551424
veli                    found with the similarity score of 0.576351
ödev                    found with the similarity score of 1.000000
Please type a query word:
EXIT
Query word:EXIT
EXIT given. Terminating.

macbook at MaCBooKs-MacBook-Pro in ~/Downloads/CMPE300_Spring_2019_MPI
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```