```
1  #include <iostream>
2  #include <fstream>
3  #include <iomanip>
4  #include <string>
5
6  using namespace std;
7
8  const int maxc = 30;
9
10 struct CityHighSchool
11 {
12 int crn;
13 string course;
14 int crhrs, numstu;
15 string prof;
16 int stucrhrs;
17 };
18
19 const CityHighSchool initrec = { 0 , "Course" , 0 , 0 , "Professor" , 0 };
20
21 void initialize(CityHighSchool C[], int &numc) {
22 int i;
23 for (i=0; i < maxc; i++) C[i] = initrec;
24 numc = 0;
25 }
26
27 void read(CityHighSchool C[], ifstream &inf, int &numc ) {
28 int curnum = 0;
29 while (!inf.eof()) {
30 inf >> C[curnum].crn >> C[curnum].course >> C[curnum].crhrs >> C[curnum].numstu >>
   C[curnum].prof >> ws;
31 curnum++;
32 }
33 numc = curnum;
34 }
35
36 void computestucrhrs(CityHighSchool C[], int numc) {
37 for (int j=0; j<numc; j++) {
38     C[j].stucrhrs = C[j].crhrs * C[j].numstu; }
39 }
40
41 int computetotalcrhrs(CityHighSchool C[], int numc) {
42 int totalcredithours = 0;
43 for (int i=0; i < numc; i++) {
44 totalcredithours += C[i].crhrs; }
45 return totalcredithours;
46 }
47
48 int computetotalnumofstudents(CityHighSchool C[], int numc) {
49 int totalnumofstudents = 0;
50 for (int i=0; i < numc; i++) {
51 totalnumofstudents += C[i].numstu; }
52 return totalnumofstudents;
53 }
```

```
54
55  int computetotalstucrhrs(CityHighSchool C[], int numc) {
56  int totalstucrhrs = 0;
57  for (int i=0; i < numc; i++) {
58  totalstucrhrs += C[i].stucrhrs; }
59  return totalstucrhrs;
60  }
61
62  void print(CityHighSchool C[], int numc, ofstream &outf) {
63  outf<< setw(21) <<" " << "City High School - Mathematics Department" << endl;
64  outf << right << setw(5) << "CRN" << setw(14) << "Course";
65  outf << setw(16) << "Credit Hrs" << setw(15) << "Stu. Count";
66  outf << setw(13) << "Professor" << setw(17) << "Sum Credit Hrs" << endl;
67  outf << setw(80) << setfill('-') << '-' << setfill(' ') << endl;
68  for (int i=0; i < numc; i++) {
69      outf << " " << left << setw(12)<< C[i].crn;
70      outf << left<< setw(16) << C[i].course << " ";
71      outf << left << setw(13) << C[i].crhrs;
72      outf << left << setw(10) << C[i].numstu << " ";
73      outf  << setw(16) << C[i].prof;
74      outf << right << setw(3) << C[i].stucrhrs << endl; }
75  outf << setw(80) << setfill('-') << '-' << setfill(' ') << endl;
76  outf << right << setw(11) << " " << "Totals:";
77  outf << setw(13) << computetotalcrhrs(C, numc);
78  outf << setw(14) << computetotalnumofstudents(C, numc);
79  outf << setw(28) << computetotalstucrhrs(C, numc);
80  outf << endl << endl;
81  }
82
83  void swap(CityHighSchool &x, CityHighSchool &y) {
84      CityHighSchool temp;
85      temp = x;
86      x=y;
87      y = temp;
88  }
89
90  void sortbystucrhrs(CityHighSchool C[], int numc) {
91  int a, b;
92  for (b = 0; b < numc - 1; b++) {
93      for (a = 0; a < numc - 1; a++) {
94          if (C[a].stucrhrs > C[a+1].stucrhrs) {
95              swap(C[a], C[a+1]); } } }
96  }
97
98  void sortbyalpha(CityHighSchool C[], int numc) {
99  for (int i = 0; i< numc -1; i++) {
100     for (int j = 0; j < numc - 1; j++) {
101         if (C[j].course < C[j+1].course) {
102             swap(C[j], C[j+1]); } } }
103 }
104
105 void computeavgstu(CityHighSchool C[], int numc, ofstream &outf) {
106 int TotalStu=0;
107 for (int i=0; i< numc; i++) {
```

```
108         TotalStu += C[i].numstu; }
109     int OverallAvg = TotalStu/numc;
110     outf << endl << "The average number of students in each section within the Math
        Department is " << OverallAvg << ".";
111     outf << endl;
112     }
113
114     void dividesubjects(CityHighSchool C[], int numc, ofstream &outf) {
115     string previouscourse = C[0].course;
116     int totalnumstu = C[0].numstu;
117     int countofsections = 1;
118     outf << endl << endl;
119     outf << "City High School - Mathematics Department" << endl;
120     outf << setw(2) << " " << "Number of Students by Course Subject" << endl;
121     outf << setw(1) << " "<< setw(23) << left << "Course" << setw(2) << "Num of
        Students" << endl;
122     outf << setw(40) << setfill('-') << '-' << setfill(' ') << endl;
123     for (int i=1; i<numc;i++) {
124         if (C[i].course == previouscourse) {
125             totalnumstu = totalnumstu + C[i].numstu;
126             countofsections++; }
127         else {
128             outf << setw(1) << " " << setw(26) << left << C[i-1].course;
129             outf << right << setw(12) << totalnumstu << endl;
130             previouscourse = C[i].course;
131             totalnumstu = C[i].numstu;
132             countofsections = 1; } }
133     outf << setw(1) << " " << setw(26) << left << previouscourse;
134     outf << right << setw(12) << totalnumstu << endl;
135     outf << setw(40) << setfill('-') << '-' << setfill(' ') << endl;
136     }
137
138
139     int main(){
140     CityHighSchool C[maxc];
141     int numc;
142     ifstream inf;
143     inf.open("datafile.txt");
144     ofstream outf;
145     outf.open("outputfile.txt");
146     initialize(C, numc);
147     read(C, inf, numc);
148     computestucrhrs(C, numc);
149     print(C, numc, outf);
150     sortbystucrhrs(C, numc);
151     print(C, numc, outf);
152     sortbyalpha(C, numc);
153     computeavgstu(C, numc, outf);
154     dividesubjects(C, numc, outf);
155     system("pause");
156     return 0;
157     }
158
```