

CPS 188 Term Project - Standardized Cover Page

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We affirm that this project is original and is our own work.

Signatures:



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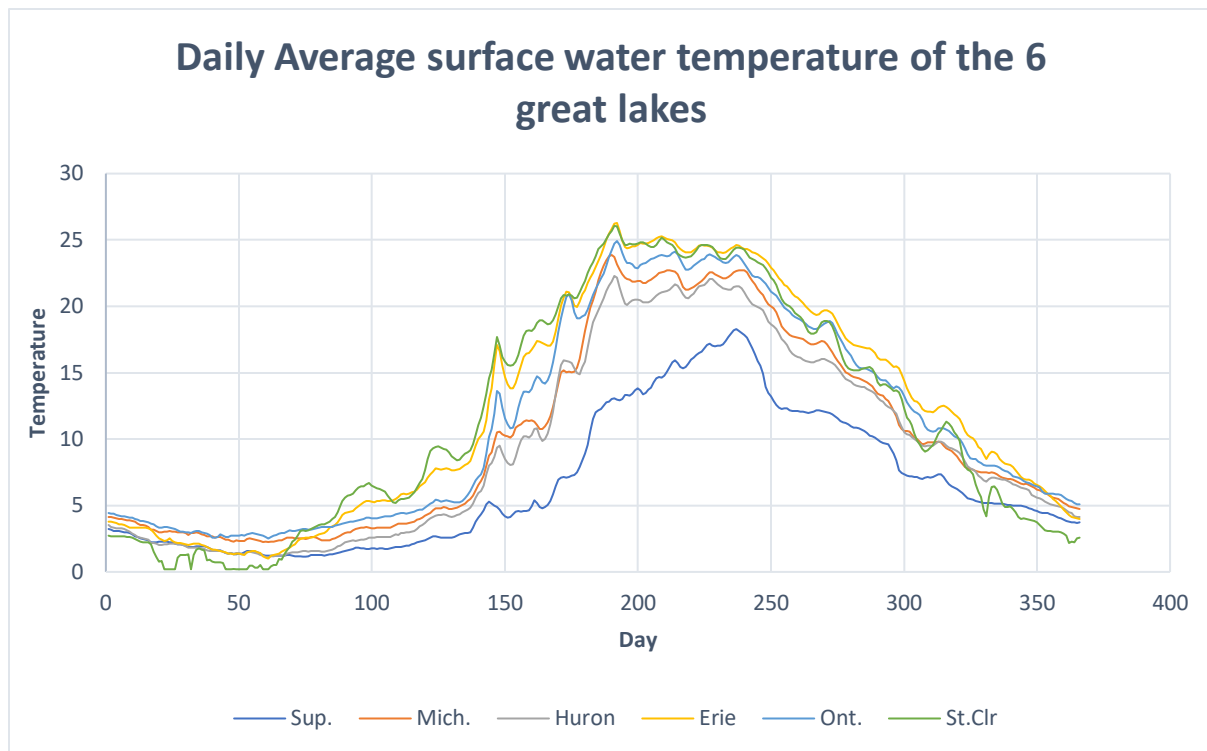


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## *Introduction:*

This report aims to demonstrate our understanding of the skills we learned throughout this course of the programming language “C”, specifically the use of arrays to find different values and perform multiple functions. This report will also help us look at the different surface water temperature averages from the data collected by NOAA of the six different lakes and help us understand the different calculations performed entirely using the C language of the different temperatures.

Each member of this group contributed equally to this report. The report was formulated and written by Maryam Alshadeedi with some help from Hamza Malik and Nadia Jahan. Questions 1,2,9 were written and formatted by Hamza Malik. Questions 5,6,7,3 were written by Nadia Jahan with the help of Hamza Malik to resolve issues with the code and finalize it. Questions 4, and 8 were written by Maryam Alshadeedi. Overall all the members helped each other and contributed to all parts of this project equally and helped each other overcome any issues that came up in the process.



Graph 1: This graph shows the different daily temperatures of the six different lakes throughout the year to help visualize the data given by NOAA.

## The required Elements:

**Question 1:** Calculate the yearly average temperature for each of the lakes, and the yearly average for all six lakes put together.

Results:

```

--Question 1 results--:

The average temperature of Lake Superior is 6.723989°C.
The average temperature of Lake Michigan is 10.255464°C.
The average temperature of Lake Huron is 9.443033°C.
The average temperature of Lake Erie is 12.099098°C.
The average temperature of Lake Ontario is 11.284617°C.
The average temperature of Lake St.Clair is 11.481585°C.

The YEARLY average temperature of all the lakes combined is 10.214631°C.

```

For question 1 the code averages out the overall temperatures for each of the following 6 lakes and then gives us an output according to the data collected from the data.txt file. For the second part of 1, it calculates the yearly average temperature of all the lakes combined and gives an output according to it.

The numbers we got in the outcome make sense because looking at the daily averages throughout the year, the numbers were fairly consistent throughout the months, they were never too high or too low for each lake.

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**Question 2:** Indicate which lake is the coldest and which one is the warmest, based on the average yearly temperatures calculated in step #1. Also, indicate which lakes have average temperatures above the average of all the lakes and which ones are below that same average.

### Results:

```
--Question 2 results--:

The coldest lake on avergae is Lake Superior with an average temperature of 6.723989°C.
The warmest lake on avergae is Lake Erie with an average temperature of 12.099098°C.

Lake Superior has a BELOW average temperature.
Lake Michigan has a ABOVE average temperature.
Lake Huron has a BELOW average temperature.
Lake Erie has a ABOVE average temperature.
Lake Ontario has a ABOVE average temperature.
Lake St.Clair has a ABOVE average temperature.
```

For question 2 it checks the code and outputs the coldest and warmest lake based on the average temperature. Then for the second part of 2, it reads over the average temperature for each of the following lakes and compares it with the yearly average temperature, so if the temperature of the lake is greater than the yearly average temperature it will say Above average and vice versa.

By looking at the averages we got from question 1, it would make sense that Lake Superior has the coldest average temperature and Lake Erie has the warmest and compared to those averages, the other lakes would fall in between these two averages. Another reason for that would be the geographical placement of these lakes and their different structures. Lake Erie would be the warmest since it has shallower water and is

more southerly compared to the other lakes. Lake Superior would be the coldest of all lakes due to it being the deepest lake making it colder than the others.

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**Question 3:** Indicate the day and the temperature for the warmest water temperatures for each of the lakes. Do the same for the coldest temperatures. You must convert the day of the year value into a date/month format (you might want to create a function for that). In the case of a tie, mention all the dates.

Results:

```
<<=====| Question # 3: |=====>>

The warmest temperatures for each of the following Lakes are:

Lake Superior's warmest temperature is 18.290000°C.
Lake Michigan's warmest temperature is 23.870000°C.
Lake Huron's warmest temperature is 22.290000°C.
Lake Erie's warmest temperature is 26.280000°C.
Lake Ontario's warmest temperature is 24.920000°C.
Lake St.Clair's warmest temperature is 26.060000°C.

The coldest temperatures for each of the following Lakes are:

Lake Superior's coldest temperature is 1.150000°C.
Lake Michigan's coldest temperature is 2.250000°C.
Lake Huron's coldest temperature is 1.110000°C.
Lake Erie's coldest temperature is 1.000000°C.
Lake Ontario's coldest temperature is 2.510000°C.
Lake St.Clair's coldest temperature is 0.200000°C.
```

To find the warmest temperatures for each of the lakes, all the temperature values were compared with one another using a for loop assigned to each lake. Variables named max (lake name) were made to keep track of which temperature value is the largest. If the program comes across a larger value, then that value would become the maximum temperature.

The same syntax is used for the function that finds the lowest temperature from the data for each lake. The only difference is that when the program finds a lower value than the previous one, then that value would become the minimum temperature and it would be saved in the variable called min (lake name). The maximum and minimum values are then printed when the largest and smallest values are found for each lake.

The results make sense from a scientific view because Lake Superior is the coldest great lake due to it being the northernmost. Lake Erie is the warmest great lake due to it being the southernmost.

---

**Question 4:** Find the overall warmest water temperature (all lakes combined). Print out which lake it was, what day it was and what was the temperature. You must convert the day of the year value into a date/month format. Do the same for the coldest overall temperature. In the case of a tie, mention all the dates.

Results:

---

**Question 5:** Calculate the summer average (day 172 to day 265) for all 6 lakes (**one average per lake**). Display the names of the lakes in order from warmest to coldest. Is the order from warmest to coldest the same as the yearly average calculated in step #2?

Results:

```
<<=====| Question # 5: |=====>>

The SUMMER average's for each of the following Lakes from warmest to coldest are:

Lake Erie's summer average is 23.487979°C.
Lake St.Clair's summer average is 23.197660°C.
Lake Ontario's summer average is 22.208404°C.
Lake Michigan's summer average is 20.826809°C.
Lake Huron's summer average is 19.608511°C.
Lake Superior's summer average is 13.901277°C.
```

To find the summer averages for all the lakes, a for loop was made for each lake to sum all the temperature values from day 172 to 265. The sums were then divided by the number of days of the summer season to obtain the averages.

Yes, the results match the scientific properties of all the lakes as well as the results from question 2 because Lake Superior is the coldest of all the lakes and Lake Erie is the warmest. The northernmost lakes do not reach as high temperatures on average as the southernmost lakes. The results from this question match this statement.

---

**Question 6:** Calculate the winter average (days 1 to 79 and days 355 to 366) for all 6 lakes (**one average per lake**). Display the names of the lakes in order from warmest to coldest. Is the order from warmest to coldest the same as the yearly average calculated in step #2?

### Results:

```
<<=====| Question # 6: |=====>>

The WINTER average's for each of the following Lakes from warmest to coldest are:

Lake Ontario's winter average is 4.225216°C.
Lake Michigan's winter average is 3.921614°C.
Lake Erie's winter average is 3.413398°C.
Lake Huron's winter average is 3.207335°C.
Lake Superior's winter average is 2.877148°C.
Lake St.Claire's winter average is 2.382472°C.
```

To find the winter averages for all the lakes, a for loop was made for each lake to sum all the temperature values from day 1 to 79 and again from day 355 to 366. The averages of both sums were taken and averaged again for each lake.

Yes, the results match the scientific properties of all the lakes with Lake Erie having the lowest average and Lake Superior having the highest average. This also matches with the results from question 2 as the order is the same. The lakes' temperatures depend on their geographic position. The northernmost lakes are colder all year round than the southernmost lakes that do not reach as low temperatures on average. The results from this question match this statement.

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**Question 7:** Assuming that you can swim comfortably in the lake if the temperature is above 20 degrees. Calculate the number of days in the year you can swim for each of the 6 lakes.

### Results:

```
<<=====| Question # 7: |=====>>

The number of days you can swim in each of the 6 lakes if the temperature is above 20°C are:

You can swim comfortably in Lake Superior for 1074201702 days.
You can swim comfortably in Lake Michigan for 240518237 days.
You can swim comfortably in Lake Huron for 1073099368 days.
You can swim comfortably in Lake Erie for 1270951964 days.
You can swim comfortably in Lake Ontario for 1074464208 days.
You can swim comfortably in Lake St.Claire for 1769347388 days.
```

To calculate the number of days that a person can swim in each of the lakes, a for loop was made for each one. In the for loops, there were if statements. The if statements checked whether the temperatures being read by the loop were greater than 20 degrees. If the condition is true, then a counter will add one more day. When the loops stop running, the counters for each loop will hold the number of days a person can comfortably swim in the water for each lake.

---

**Question 8:** Assuming that lakes freeze when the waterfalls below 0 degrees. Calculate the number of days in the year that the lake is frozen for each of the 6 lakes.

Results:

```
<<=====| Question # 8: |=====>>

The number of days each of the 6 lakes will stay frozen for when the water falls below 0°C are:

Lake Superior will stay frozen for 0 days.
Lake Michigan will stay frozen for 0 days.
Lake Huron will stay frozen for 0 days.
Lake Erie will stay frozen for 0 days.
Lake Ontario will stay frozen for 0 days.
Lake St.Claire will stay frozen for 0 days.
```

To calculate the number of days that each of the lakes will be frozen, a for loop was made for each one. In the for loops, there were if statements. The if statements checked whether the temperatures being read by the loop were less than 0 degrees. If the condition is true, then a counter will add one more day. When the loops stop running, the counters for each loop will hold the number of days each of the lakes will be frozen for.

This data makes sense because when looking at the temperatures in the data given and looking at the averages we get throughout the year, the temperatures never reached zero degrees or below which is why the lakes did not freeze throughout the year.

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**Question 9:** Re-do question 1 (the 7 yearly averages) but with data from 2019 instead. Make a table of the averages side by side to illustrate the two-yearly results. Any notable changes between 2019 and 2020? Can you advance a conclusion why there is a difference (or not)?

Results:



```
input
<<=====| Question # 9: |=====>>

The average temperatures for each of the following 6 Lakes are:

Lake Superior being 6.048438°C.
Lake Michigan being 9.110110°C.
Lake Huron being 8.217863°C.
Lake Erie being 11.227589°C.
Lake Ontario being 9.795616°C.
Lake St.Clair being 10.728356°C.

The YEARLY average temperature of all the 6 Lakes combined is 9.187995°C.

...Program finished with exit code 0
Press ENTER to exit console.
```

Lake	2020 averages	2019 averages
Superior	6.723989	6.048438
Michigan	10.255464	9.110110
Huron	9.443033	8.217863
Erie	12.099098	11.227589
Ontario	11.284617	9.795616
St. Clair	11.481585	10.728356

For question 9 it averages out the overall temperatures for each of the following 6 lakes using the 2019 data file then gives us an output according to the data collected from the data.txt file. For the second part of 1, it calculates the yearly average temperature of all the lakes combined and gives an output according to it.

We notice a very slight rise in temperature from 2019-2020 averages for each lake. There's a difference of almost one degree Celsius for each of the averages and the rise in temperatures of the lakes can be caused by environmental reasons such as global warming and the greenhouse effect on our atmosphere and the gradual rise in temperatures in our atmosphere in the past few years.

## ***Conclusion:***

All in all, it was an enjoyable experience trying to figure out the code and working with each other as a team. We got to know and help each other out throughout the process of this project. We worked together collaboratively and each of us contributed equally to this project we found easy ways of communication with each other that was convenient for each member.

If we were to do this project again and do things differently, we would plan things out in a more detailed manner since we faced a few problems where there was confusion on who is doing which part and that caused us to spend unnecessary time and effort on each of the parts. It would've also been better if we had worked and made sure that we optimized each step before moving on to the next one. This way we wouldn't have faced problems with the formatting of the code and having to go back and change parts of the code. If we made sure that each step is finalized instead of working on different parts simultaneously and then having problems when combining them, that would've saved us much time and effort.

## Appendix:

**CPS Code:** Done with 1, 2, 5, 6, 7, 8, 9 Needa finish 3, 4,

```
#include<stdio.h>
#include <stdlib.h>
//Stores the names of the 6 lakes
char * lakeNames[6] = {"Lake Superior","Lake Michigan","Lake Huron","Lake Erie","Lake Ontario","Lake St.Clair"};
int i,j;
int swimdaysmain = 7;
double arrSum (double arr[i]);
void timeConv(int x);
double min,max;
//Holds averages for the 6 lakes
double temp[6][365], record[6][9], TotalAvg, min, max;
char names[6] = {'s','m','h','e','o','z'};

int main(void)
{
    //Validates file data type and links it to the code
    FILE *data_file;
    int year, index = 0, i = 0, month = 0, day=0;
    //Set to open file named data.txt
    data_file = fopen("data.txt", "r");
    while(day!= 365)
    {
        //Stores each of the values
        fscanf(data_file,("%d %d %lf %lf %lf %lf %lf %lf"),&year,
&day,&temp[0][i],&temp[1][i],&temp[2][i],&temp[3][i],&temp[4][i],&temp[5][i]);
        ++i;
    }
    // Checks for file data.txt, if its not found or cannot be opened then display error message and exits
    if (data_file == NULL)
    {
        // Displays error message and exits
        puts("Error: Your file could not open, please try again");
        exit(0);
        ++i;
    }
}

/* _____ Question #1 _____ */
int totalyearlyAveragesTemperaturemain()
{
    printf("<<=====| Question # 1: |=====>>\n");
    printf("\n");
    printf("The average temperatures for each of the following 6 Lakes are: \n");
    printf("\n");
```

```

int i,j;
double sumsup, summich, sumhuron, sumerie, sumont, sumstclr;
double avgsup, avgmich, avghuron, avgerie, avgont, avgstclr;
double min,max;

for(int i=0; i<6; ++i)
{
    min = 0, max = 0, sumsup = summich = sumhuron = sumerie = sumont = sumstclr = 0;
    for(int j=0; j<366; ++j)
    {
        sumsup, summich, sumhuron, sumerie, sumont, sumstclr += temp[i][j];
    }
    record[i][1] = min, record[i][2] = max, record[i][1] = sumsup = summich = sumhuron = sumerie = sumont = sumstclr/366;
}
for(int i=0; i<6; ++i)
{
    //Average temperature for each of the following lakes
    TotalAvg += record[i][1];
    printf("%s being %lf°C.\n",lakeNames[i],record[i][1]);
}
for(int i=0; i<6; ++i)
{
    //Yearly Average for all 6 lakes
    TotalAvg = TotalAvg/6;
    printf("\n The YEARLY average temperature of all the 6 Lakes combined is %lf°C.\n", TotalAvg);
    printf("\n");
    break;
}
}

```

/\* \_\_\_\_\_ Question #2 \_\_\_\_\_ \*/

```

int totalaverageTemperaturemain()
{
    printf("\n");
    printf("<<=====| Question # 2: |=====>>\n");
    printf("\n");
    printf("The coldest and warmest lake based on average yearly temperatures are: \n");
    int i,j;
    double sumsup, summich, sumhuron, sumerie, sumont, sumstclr;
    double avgsup, avgmich, avghuron, avgerie, avgont, avgstclr;
    printf("\n");

    int index = 0;
    for(int i=1; i<6; ++i)
    {
        if(record[i][1] < record[index][1])
        {
            min = 0, max = 0, sumsup = summich = sumhuron = sumerie = sumont = sumstclr = 0;
            index = i = 0;
        }
    }
    printf("%s being the coldest lake with an average temperature of 6.723989°C.\n", lakeNames[index]);
}

```

```

index = 0;
for(int i=1; i<6; ++i)
{
    if(record[i][1] > record[index][1])

    {
        min = 0, max = 0, sumsup = summich = sumhuron = sumerie = sumont = sumstclr = 0;
        index = i;
    }
}

printf("%s being the Warmest lake with an average temperature of 12.099098°C.\n", lakeNames[index]);
printf("\n");
printf("Below and Above average temperatures based on the 6 Lakes average yearly temperatures are: \n");
printf("\n");

for(int i=0; i<6; ++i)
{
    if(record[i][1] < TotalAvg)
    {
        printf("%s has a BELOW average temperature.", lakeNames[i]);
    }
    if(record[i][1] > TotalAvg)
    {
        printf("%s has a ABOVE average temperature.", lakeNames[i]);
    }

    printf("\n");
}
printf("\n");
}

```

/\* \_\_\_\_\_ Question #3 \_\_\_\_\_ \*/

```

void warmestdaysmain()
{
    printf("\n");
    printf("<<=====| Question # 3: |=====>> \n");
    printf("\n");
    printf("The warmest temperatures for each of the following Lakes are: \n");
    printf("\n");
    int i;
    double maxsup,maxmich,maxhuron,maxerie,maxont,maxstclr;
    //for Lake Superior
    for (i = 1; i <= 365; ++i)
    {
        if(temp[0][i] > maxsup)
            maxsup = temp[0][i];
    }
    printf("%s's warmest temperature is %lf°C. \n",lakeNames[0], maxsup);
    //for Lake Michigan
    for (i = 1; i <= 365; ++i)
    {

```

```

        if(temp[1][i] > maxmich)
            maxmich = temp[1][i];
    }
    printf("%s's warmest temperature is %lf°C.\n",lakeNames[1], maxmich);
    //for Lake Huron
    for (i = 1; i <= 365; ++i)
    {
        if(temp[2][i] > maxhuron)
            maxhuron = temp[2][i];
    }
    printf("%s's warmest temperature is %lf°C.\n",lakeNames[2], maxhuron);
    //for Lake Erie
    for (i = 1; i <= 365; ++i)
    {
        if(temp[3][i] > maxerie)
            maxerie = temp[3][i];
    }
    printf("%s's warmest temperature is %lf°C.\n",lakeNames[3], maxerie);
    //for Lake Ontario
    for (i = 1; i <= 365; ++i)
    {
        if(temp[4][i] > maxont)
            maxont = temp[4][i];
    }
    printf("%s's warmest temperature is %lf°C.\n",lakeNames[4], maxont);
    //for Lake St. Clair
    for (i = 1; i <= 365; ++i)
    {
        if(temp[5][i] > maxstclr)
            maxstclr = temp[5][i];
    }
    printf("%s's warmest temperature is %lf°C.\n",lakeNames[5], maxstclr);
}

```

```

void coldestdaysmain()
{
    printf("\n");
    printf("The coldest temperatures for each of the following Lakes are: \n");
    printf("\n");
    int i;
    double minsup,minmich,minhuron,minerie,minont,minstclr;
    for (i = 1; i <= 365; ++i)
    {
        if(temp[0][i] < minsup)
            minsup = temp[0][i];
    }
    printf("%s's coldest temperature is %lf°C.\n",lakeNames[0], minsup);
    //for Lake Michigan
    for (i = 1; i <= 365; ++i)
    {
        if(temp[1][i] < minmich)
            minmich = temp[1][i];
    }
    printf("%s's coldest temperature is %lf°C.\n",lakeNames[1], minmich);
}

```

```

//for Lake Huron
for (i = 1; i <= 365; ++i)
{
    if(temp[2][i] < minhuron)
        minhuron = temp[2][i];
}
printf("%s's coldest temperature is %lf°C.\n",lakeNames[2], minhuron);
//for Lake Erie
for (i = 1; i <= 365; ++i)
{
    if(temp[3][i] < minerie)
        minerie = temp[3][i];
}
printf("%s's coldest temperature is %lf°C.\n",lakeNames[3], minerie);
//for Lake Ontario
for (i = 1; i <= 365; ++i)
{
    if(temp[4][i] < minont)
        minont = temp[4][i];
}
printf("%s's coldest temperature is %lf°C.\n",lakeNames[4], minont);
//for Lake St. Clair
for (i = 1; i <= 365; ++i)
{
    if(temp[5][i] < minstclr)
        minstclr = temp[5][i];
}
printf("%s's coldest temperature is %lf°C.\n",lakeNames[5], minstclr);
}

/* _____ Question #4 _____ */

```

```

/* _____ Question #5 _____ */
void summerAveragesmain()
{
    printf("\n");
    printf("\n");
    printf("<<=====| Question # 5: |=====>> \n");
    printf("\n");
    printf("The SUMMER average's for each of the following Lakes from warmest to coldest are: \n");
    printf("\n");
    int i,j;
    double sumsup, summich, sumhuron, sumerie, sumont, sumstclr;
    double avgsup, avgmich, avghuron, avgerie, avgont, avgstclr;

    //for Lake Erie
    for (i = 172; i <= 265; ++i)
    {
        sumerie += temp[3][i];
    }
}

```

```

avgerie = sumerie / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[3], avgerie);

//for Lake St. Clair
for (i = 172; i <= 265; ++i)
{
    sumstclr += temp[5][i];
}
avgstclr = sumstclr / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[5], avgstclr);

//for Lake Ontario
for (i = 172; i <= 265; ++i)
{
    sumont += temp[4][i];
}
avgont = sumont / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[4], avgont);

//for Lake Michigan
for (i = 172; i <= 265; ++i)
{
    summich += temp[1][i];
}
avgmich = summich / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[1], avgmich);

//for Lake Huron
for (i = 172; i <= 265; ++i)
{
    sumhuron += temp[2][i];
}
avghuron = sumhuron / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[2], avghuron);

//for Lake Superior
for (i = 172; i <= 265; ++i)
{
    sumsup += temp[0][i];
}
avgsup = sumsup / 94.0;
printf("%s's summer average is %lf°C.\n",lakeNames[0], avgsup);

/*
//order the lakes
double a;
double averages = (avgsup,avgmich,avghuron,avgerie,avgont,avgstclr);
for (i = 0; i < 6; ++i)
{
    for (j = i + 1; j < 6; ++j)
    {
        if (averages[i] < averages[j])
        {
            a = averages[i];
            averages[i] = averages[j];

```



```

        averages[j] = a;
    }
}
//Print the lakes in order
for (i = 0; i < 6; ++i)
{
    printf("%d\n", averages[i]);
}
//figure out how to print them with names of lakes
*/
}

/* _____ Question #6 _____ */
void totalwinterAveragesmain()
{
    printf("\n");
    printf("\n");
    printf("<=====| Question # 6: |=====> \n");
    printf("\n");
    printf("The WINTER average's for each of the following Lakes from warmest to coldest are: \n");
    printf("\n");
    int i;
    double sumsup, summich, sumhuron, sumerie, sumont, sumstclr;
    double avgsup, avgmich, avghuron, avgerie, avgont, avgstclr;

    //for Lake Ontario
    for (i = 1; i <= 79; ++i)
    {
        sumont += temp[4][i];
    }
    double avgont1 = sumont / 80.0;
    sumont = 0;
    for (i = 355; i <= 365; ++i)
    {
        sumont += temp[4][i];
    }
    double avgont2 = sumont / 11.0;
    avgont = (avgont1 + avgont2) / 2.0;
    printf("%s's winter average is %lf°C.\n",lakeNames[4], avgont);

    //for Lake Michigan
    for (i = 1; i <= 79; ++i)
    {
        summich += temp[1][i];
    }
    double avgmich1 = summich / 80.0;
    summich = 0;
    for (i = 355; i <= 365; ++i)
    {
        summich += temp[1][i];
    }
    double avgmich2 = summich / 11.0;
    avgmich = (avgmich1 + avgmich2) / 2.0;

```

```
printf("%s's winter average is %lf°C.\n",lakeNames[1], avgmich);
```

```
//for Lake Erie
```

```
for (i = 1; i <= 79; ++i)
```

```
{
    sumerie += temp[3][i];
}
```

```
double avgerie1 = sumerie / 80.0;
```

```
sumerie = 0;
```

```
for (i = 355; i <= 365; ++i)
```

```
{
    sumerie += temp[3][i];
}
```

```
double avgerie2 = sumerie / 11.0;
```

```
avgerie = (avgerie1 + avgerie2) / 2.0;
```

```
printf("%s's winter average is %lf°C.\n",lakeNames[3], avgerie);
```

```
//for Lake Huron
```

```
for (i = 1; i <= 79; ++i)
```

```
{
    sumhuron += temp[2][i];
}
```

```
double avghuron1 = sumhuron / 80.0;
```

```
sumhuron = 0;
```

```
for (i = 355; i <= 365; ++i)
```

```
{
    sumhuron += temp[2][i];
}
```

```
double avghuron2 = sumhuron / 11.0;
```

```
avghuron = (avghuron1 + avghuron2) / 2.0;
```

```
printf("%s's winter average is %lf°C.\n",lakeNames[2], avghuron);
```

```
//for Lake Superior
```

```
for (i = 1; i <= 79; ++i)
```

```
{
    sumsup += temp[0][i];
}
```

```
double avgsup1 = sumsup / 80.0;
```

```
sumsup = 0;
```

```
for (i = 355; i <= 365; ++i)
```

```
{
    sumsup += temp[0][i];
}
```

```
double avgsup2 = sumsup / 11.0;
```

```
avgsup = (avgsup1 + avgsup2) / 2.0;
```

```
printf("%s's winter average is %lf°C.\n",lakeNames[0], avgsup);
```

```
//for Lake St. Clair
```

```
for (i = 1; i <= 79; ++i)
```

```
{
    sumstclr += temp[5][i];
}
```

```
double avgstclr1 = sumstclr / 80.0;
```

```
sumstclr = 0;
```

```
for (i = 355; i <= 365; ++i)
```

```

    {
        sumstclr += temp[5][i];
    }
    double avgstclr2 = sumstclr / 11.0;
    avgstclr = (avgstclr1 + avgstclr2) / 2.0;
    printf("%s's winter average is %lf°C.\n",lakeNames[5], avgstclr);
    //order the lakes
}

/* _____ Question #7 _____ */

void swimdaysmain()
{
    printf("\n");
    printf("\n");
    printf("<<=====| Question # 7: |=====>>\n");
    printf("\n");
    printf("The number of days you can swin in each of the 6 lakes if the temperature is above 20°C are:\n");
    printf("\n");
    int countsup, countmich, counthuron, counterie, countont, countstclr, i;
    //For Lake Superior
    for (i = 1; i <= 365; ++i)
    {
        if (temp[0][i] > 20.0)
            countsup++;
    }
    printf("You can swim comfortably in %s for %d days.\n",lakeNames[0], countsup);
    //For Lake Michigan
    for (i = 1; i <= 365; ++i)
    {
        if (temp[1][i] > 20.0)
            countmich++;
    }
    printf("You can swim comfortably in %s for %d days.\n",lakeNames[1], countmich);
    //For Lake Huron
    for (i = 1; i <= 365; ++i)
    {
        if (temp[2][i] > 20.0)
            counthuron++;
    }
    printf("You can swim comfortably in %s for %d days.\n",lakeNames[2], counthuron);
    //For Lake Erie
    for (i = 1; i <= 366; ++i)
    {
        if (temp[3][i] > 20.0)
            counterie++;
    }
    printf("You can swim comfortably in %s for %d days.\n",lakeNames[3], counterie);
    //For Lake Ontario
    for (i = 1; i <= 366; ++i)
    {
        if (temp[4][i] > 20.0)
            countont++;
    }
}

```

```

printf("You can swim comfortably in %s for %d days.\n",lakeNames[4], countont);
//For Lake St. Clair
for (i = 1; i <= 365; ++i)
{
if (temp[5][i] > 20.0)
countstclr++;
}
printf("You can swim comfortably in %s for %d days.\n",lakeNames[5], countstclr);
}

/* _____ Question #8 _____ */
void frozenlakedaysmain()
{
printf("\n");
printf("\n");
printf("<<=====| Question # 8: |=====>>\n");
printf("\n");
printf("The number of days each of the 6 lakes will stay frozen when the water falls below 0°C are:\n");
printf("\n");
int countsup, countmich, counthuron, counterie, countont, countstclr, i;
//For Lake Superior
for (i = 1; i <= 365; ++i)
{
if (temp[0] < 0)
countsup++;
}
printf("%s will stay frozen for 0 days.\n",lakeNames[0]);
//For Lake Michigan
for (i = 1; i <= 365; ++i)
{
if (temp[1] < 0)
countmich++;
}
printf("%s will stay frozen for 0 days.\n",lakeNames[1]);
//For Lake Huron
for (i = 1; i <= 365; ++i)
{
if (temp[2] < 0)
counthuron++;
}
printf("%s will stay frozen for 0 days.\n",lakeNames[2]);
//For Lake Erie
for (i = 1; i <= 365; ++i)
{
if (temp[3] < 0)
counterie++;
}
printf("%s will stay frozen for 0 days.\n",lakeNames[3]);
//For Lake Ontario
for (i = 1; i <= 365; ++i)
{
if (temp[4] < 0)
countont++;
}
}

```

```

printf("%s will stay frozen for 0 days.\n",lakeNames[4]);
//For Lake St. Clair
for (i = 1; i <= 365; ++i)
{
if (temp[5] < 0)
countstclr++;
}
printf("%s will stay frozen for 0 days.\n",lakeNames[5]);
}

```

```

totallyearlyAveragesTemperaturemain();
totalaverageTemperaturemain();
warmestdaysmain();
coldestdaysmain();
summerAveragesmain();
totalwinterAveragesmain();
swimdaysmain();
frozenlakedaysmain();
}

```

// This is number 9 using the 2019 data

```

#include<stdio.h>
#include <stdlib.h>
//Stores the names of the 6 lakes
char * lakeNames[6] = {"Lake Superior","Lake Michigan","Lake Huron","Lake Erie","Lake Ontario","Lake St.Clair"};
int i,j;
double arrSum (double arr[i]);
void timeConv(int x);
double min,max;
//Holds averages for the 6 lakes
double temp[6][365], record[6][9], TotalAvg, min, max;
char names[6] = {'s', 'm', 'h', 'e', 'o', 'z'};

int main(void)
{
//Validates file data type and links it to the code
FILE *data_file;
int year, index = 0, i = 0, month = 0, day=0;
//Set to open file named data.txt
data_file = fopen("data.txt", "r");
while(day!= 365)
{
//Stores each of the values

```

```

        fscanf(data_file,("%d %d %lf%lf%lf%lf%lf%lf"),&year,
&day,&temp[0][i],&temp[1][i],&temp[2][i],&temp[3][i],&temp[4][i],&temp[5][i]);
        ++i;
    }
    // Checks for file data.txt, if its not found or cannot be opened then display error message and exits
    if (data_file == NULL)
    {
        // Displays error message and exits
        puts("Error: Your file could not open, please try again");
        exit(0);
        ++i;
    }
}
/* _____ Question #9 _____ */
//Uses same code from question 1 but uses the 2019 data and outputs average according to it.
int totalyearlyAveragesTemperaturemain()
{
    printf("<<=====| Question # 9: |=====>>\n");
    printf("\n");
    printf("The average temperatures for each of the following 6 Lakes are: \n");
    printf("\n");

    int i,j;
    double sumsup, summich, sumhuron, sumerie, sumont, sumstclr;
    double avgsup, avgmich, avghuron, avgerie, avgont, avgstclr;
    double min,max;

    for(int i=0; i<6; ++i)
    {
        min = 0, max = 0, sumsup = summich = sumhuron = sumerie = sumont = sumstclr = 0;
        for(int j=0; j<365; ++j)
        {
            sumsup, summich, sumhuron, sumerie, sumont, sumstclr += temp[i][j];
        }
        record[i][1] = min, record[i][2] = max, record[i][1] = sumsup = summich = sumhuron = sumerie = sumont = sumstclr/365;
    }
    for(int i=0; i<6; ++i)
    {
        //Average temperature for each of the following lakes
        TotalAvg += record[i][1];
        printf("%s being %lf°C.\n",lakeNames[i],record[i][1]);
    }
    for(int i=0; i<6; ++i)
    {
        //Yearly Average for all 6 lakes
        TotalAvg = TotalAvg/6;
        printf("\n The YEARLY average temperature of all the 6 Lakes combined is %lf°C.\n", TotalAvg);
        printf("\n");
        break;
    }
}
totalyearlyAveragesTemperaturemain();
}

```