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Software Engineering Department

Assembly Languages Course - final assignment

Frequency Distribution Graph Application

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1 Frequency Distribution application design

The user chooses the input type of the grades array, If the user inputs 0 the program will run the distribution graph for the grades that are already in the code

int Grades[] = { 0, 1, 2, 55, 11, 22, 33, 44, 56, 57, 99, 100, 58, 66, 76, 78, 77, 77, 77, 88, -999 };

If the user inputs 1 the program will take grades input from the user until the user inputs -999. After inputting each grade the user presses Enter.

Input grades 1 at a time followed by 'Enter':

>85CR

>95CR …

>-999CR

(The user is allowed to input grades between 0 to 100 ONLY)

Major Design/Implementation Decisions

After the user inputs the grades, the CheckGrades function is called to distribute the grades to the right intervals, according to the amount of grades in each interval the function increments the frequency of the grade accordingly.
The calculations of the average grade, Maximum/Minimum intervals, Number of Students are calculated using two separate functions.
The Graph is printed using the PrintStars function that takes the start of the Frequencies array as input and prints the graph accordingly.
The stack was used in the code to print the maximum/minimum intervals.

1.1 The High-level Algorithm

```c
#include <stdio.h>

#define MAX_GRADES 100

void calculateFrequency(int *Grades, int *frequencies);

int main()
{
    int Grades[] = {0, 1, 2, 55, 11, 22, 33, 44, 56, 57, 99, 100, 58, 66,
76, 78, 77, 77, 77, 88, -999};
    int frequencies[10] = {0};
    int numStudents = 0;
    int sumGrades = 0;
    int maxFreq = 0;
    int minFreq = MAX_GRADES;

    // Calculate frequency distribution
    calculateFrequency(Grades, frequencies);

    // Calculate number of students and sum of grades
    int i = 0;
    while (Grades[i] != -999)
    {
        numStudents++;
        sumGrades += Grades[i];
        i++;
```

```c
    }

    // Calculate max and min frequency using a while loop
    i = 0; // Reset the loop counter
    while (i < 10)
    {
        if (frequencies[i] > maxFreq)
        {
            maxFreq = frequencies[i];
        }

        if (frequencies[i] < minFreq && frequencies[i] != 0)
        {
            minFreq = frequencies[i];
        }

        i++;
    }

    // Calculate average grade
    double averageGrade = (double)sumGrades / numStudents;

    // Print the frequency distribution and histogram
    printf("Number of students = %d\n", numStudents);
    printf("Average grade = %.2f\n", averageGrade);
    printf("Interval Grade Frequency\n");
    for (i = 0; i < 10; i++)
    {
        if (i == 9)
        {
            printf("90-100: %d ", frequencies[i]);
        }
        else
        {
            printf("%2d-%2d: %d ", i * 10, i * 10 + 9, frequencies[i]);
        }
        for (int j = 0; j < frequencies[i]; j++)
        {
            printf("*");
        }
        printf("\n");
    }

    // Print statistics
    printf("Grade distribution: Max = %d Min = %d\n", maxFreq, minFreq);

    return 0;
}

void calculateFrequency(int *Grades, int *frequencies)
{
```

```
    int i = 0;

    while (Grades[i] != -999)
    {
        int grade = Grades[i];
        int gradeInterval;

        if (grade == 100)
        {
            gradeInterval = 9; // Map 100 to interval 90-100
        }
        else
        {
            gradeInterval = grade / 10; // Divide by 10 to get the interval
        }

        frequencies[gradeInterval]++;
        i++;
    }
}
```

2   The User Guide

1. When running the application please wait for the output to finish and then press 0 for the option of the built in grades array distribution, press 1 to input grades manually one by one.

    Error messages will appear in these cases:
    - If the inputted grade is a negative number.
    - If the inputted grade is a number bigger than 100.

2. After inputting the grades please make sure to input the terminator value of -999, after inputting the terminator value please patiently wait for the output of the graph it will take 1-2 minutes.