**1. Topic – Plotting Bar diagram of age groups by generating random ages withen (0-100) using rand() function in C program**

* **Problem Statement**

**(a) Create a function that randomly generates 10000 numbers from 0 to 100. (b) Consider the random numbers generated in (a) are ages of 10000 people living in your locality/village/town. You need to count how many people are of a particular age,i.e., number of people with age 0, 1, 2, 3, ... 100. Print this list as Age a = count Print number of people in each age groups [0 − 10], [11 − 20], · .. [91 − 100].See the execution time of your program. (c) Print the bar plot of count of people in all the 10 age groups.Use '\*' or any other special character to plot the graph.**

**Input example:**  Here input is already given in the program assuming the ages should be withen 0 to 100 for 10000 people so we have to generate 10000 random numbers withen 0 to 100 to perform the calculations.

**Output example:** \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*The count of people of a particular age are\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Age 0 = 101 Age 1 = 106 Age 2 = 104 Age 3 = 94 Age 4 = 106 Age 5 = 117 Age 6 = 95

Age 7 = 112 Age 8 = 117 Age 9 = 81 Age 10 = 102 Age 11 = 114 Age 12 = 112 Age 13 = 104 Age 14 = 107

Age 15 = 114 Age 16 = 97 Age 17 = 92 Age 18 = 100 Age 19 = 98 Age 20 = 95 Age 21 = 102

Age 22 = 110 Age 23 = 89 Age 24 = 108 Age 25 = 103 Age 26 = 93 Age 27 = 87 Age 28 = 89

Age 29 = 93 Age 30 = 97 Age 31 = 103 Age 32 = 101 Age 33 = 106 Age 34 = 74 Age 35 = 90

Age 36 = 109 Age 37 = 100 Age 38 = 100 Age 39 = 99 Age 40 = 89 Age 41 = 110 Age 42 = 113

Age 43 = 105 Age 44 = 110 Age 45 = 112 Age 46 = 117 Age 47 = 103 Age 48 = 87 Age 49 = 93

Age 50 = 96 Age 51 = 102 Age 52 = 98 Age 53 = 105 Age 54 = 96 Age 55 = 83 Age 56 = 82

Age 57 = 102 Age 58 = 94 Age 59 = 84 Age 60 = 104 Age 61 = 101 Age 62 = 96 Age 63 = 91

Age 64 = 100 Age 65 = 108 Age 66 = 91 Age 67 = 89 Age 68 = 96 Age 69 = 108 Age 70 = 92

Age 71 = 101 Age 72 = 94 Age 73 = 78 Age 74 = 105 Age 75 = 106 Age 76 = 81 Age 77 = 104

Age 78 = 100 Age 79 = 98 Age 80 = 92 Age 81 = 93 Age 82 = 104 Age 83 = 84 Age 84 = 99

Age 85 = 93 Age 86 = 123 Age 87 = 81 Age 88 = 95 Age 89 = 99 Age 90 = 94 Age 91 = 104

Age 92 = 106 Age 93 = 102 Age 94 = 93 Age 95 = 100 Age 96 = 79 Age 97 = 114 Age 98 = 95

Age 99 = 104 Age 100 = 101

The number of people in the age group ( 0- 10) is ---- 1135

The number of people in the age group ( 11- 20) is ---- 1033

The number of people in the age group ( 21- 30) is ---- 971

The number of people in the age group ( 31- 40) is ---- 971

The number of people in the age group ( 41- 50) is ---- 1046

The number of people in the age group ( 51- 60) is ---- 950

The number of people in the age group ( 61- 70) is ---- 972

The number of people in the age group ( 71- 80) is ---- 959

The number of people in the age group ( 81- 90) is ---- 965

The number of people in the age group ( 91-100) is ---- 998

The horizontal bar diagram with taking the scale 1:10

0- 10 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

11- 20 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

21- 30 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

31- 40 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

41- 50 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

51- 60 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

61- 70 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

71- 80 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

81- 90 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

91-100 : \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

The vertical bar diagram with taking the scale 1:10

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0- 10 11- 20 21- 30 31- 40 41- 50 51- 60 61- 70 71- 80 81- 90 91-100

The total time of execution is 0.124000 seconds

* **Proposed C Code**

**/\* ---------- random\_numbers.c--------------- \*/**

#include<stdio.h>

#include<stdlib.h>

#include<time.h>

int main()

{

clock\_t start\_time,end\_time;

double execution\_time;

start\_time = clock(); /\*It is done for noting the starting time of execution \*/

int age;

srand(time(0));

/\* time(0) is used to give different values in srand() so in different time different random numbers are genarated\*/

int\* agecount = (int\*)calloc((101),sizeof(int));

/\*agecount array is used to find the frequency of the people of every age in the locality ranging from 0 to 100 \*/

int\* age\_group\_array = (int\*)calloc((101)/10,sizeof(int));

/\*age\_group\_array is used to find the frequency of every age group like (0-10),(11-20) etc in the locality ranging from 0 to 100 \*/

for ( int i = 0 ; i < 10000 ; i++ )

{

age = rand()%(101) ;

/\* Random numbers as ages are generated by rand() function \*/

agecount[age]++;

int group=(age-1)/10;

/\* If age is 92 then (age-1)/10 will give group no 9 so age-1 is divided by 10 to make actual groups \*/

age\_group\_array[group]++;

/\* counting the frequencies of both age groups and individual ages \*/

}

printf("\n\n\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*The count of people of a particular age are\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n\n");

for ( int i = 0 ; i <= 100 ; i++ )

{

printf("Age %3d = %3d\t",i,agecount[i]);

}

printf("\n\nThe number of people in the age group ( 0- 10) is ---- %d\n",age\_group\_array[0]);

int max=age\_group\_array[0]/10;

/\* Here max is the variable created to find the largest frequency,it is divided by 10 as the bar plots are done with scale 1:10\*/

for ( int i = 1 ; i < 10 ; i++ )

{

printf("The number of people in the age group (%3d-%3d) is ---- %d\n", i\*10 +1 , (i+1)\*10 , age\_group\_array[i]);

if(max<age\_group\_array[i]/10)

max=age\_group\_array[i]/10;

}

printf("\n\nThe horizontal bar diagram with taking the scale 1:10\n\n");

/\* The horizontal bar diagram is printed using '\*' in the scale 1 : 10 \*/

/\* horizontal bar diagram for (0-10) is done at first \*/

printf(" 0- 10 : ");

for ( int i = 0 ; i < age\_group\_array[0]/10 ; i++ )

{

printf("\*");

}

printf("\n");

for ( int i = 1 ; i < 10 ; i++ )

{

printf("%3d-%3d : ",i\*10+1,(i+1)\*10);

for ( int j = 0 ; j < age\_group\_array[i]/10 ; j++ )

{

printf("\*");

}

printf("\n");

}

printf("\n\nThe vertical bar diagram with taking the scale 1:10\n\n");

/\* At first we found the maximum among the age\_group\_array which is found initially. It is the number of times the outer for loop will run for vertical line diagram. We will print \* using inner for loop. For the first row ,the age\_group\_array[j]/10 will match the maximum then we will print \* .So for this reason in every step we reduce the maximum by 1 and make a condition that if reduced maximum <= age\_group\_array[j] then only we will print \* otherwise will print '\t'. \*/

for (int i = 0; i < max ; i++)

{

for ( int j = 0 ; j < 10 ; j++ )

{

if(max>age\_group\_array[j]/10)

printf("\t");

else

printf("\* ");

}

printf("\n");

max--;

}

/\* The age groups are also printed below the vertical bar diagram \*/

printf("0- 10\t");

for ( int i = 1 ; i < 10 ; i++ )

{

printf("%d-%3d\t",i\*10+1,(i+1)\*10);

}

/\* The clock is ended \*/

end\_time = clock();

execution\_time = (double)(end\_time - start\_time)/CLOCKS\_PER\_SEC ;

/\* The total time in seconds \*/

printf("\nThe total time of execution is %lf seconds\n",execution\_time);

return 0;

}

**/\*------------------------------------------------------------------------------------------------------------------------- \*/**

* **Conclusion**

**The proposed algorithm has a runtime of O(n^2) where n is the generally the input size as well as number of iterations under consideration.**

* **Limitations : As the input size is 10000 so the frequency of each group is very large, so we are plotting the horizontal and vertical bar diagrams with 1:10 scale for clear visibility. So in these case if there are two very close frequency values their bar plots will be almost same on the screen.**
* **Assumptions: Here we are considering the age values withen 0 to 100 over 10000 people,so all our calculations are based on these assumptions.**