# CS1100 – Introduction to Programming

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Lecture 15

# CS1100 – Introduction to Programming

- Programming : From Turtle to C.
- Data Types in C, Operators. Input and the Output.
- Modifying the control flow in Programs `if-else`, `switch`, loops : `while`, `do-while`, `for`.

} So far ...

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- `One-dimensional Arrays` in C.

} Coming Up

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Difficulties : Size of the input data is huge !
See example 1 : defining a variable for each mark is not feasible

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  - store 100 integers.
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- `int marks[7];`

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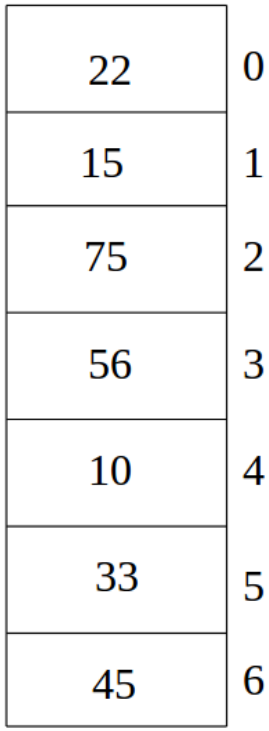
- **Declaration :**
  `data-type array-name[array-size];`
- `int marks[7];`
- `char name[10];`
- `float score[1000];` - defines 1000 variables!
- the value of `marks[2]` is 75.
- new values can be assigned to elements
  `marks[3] = 36;`



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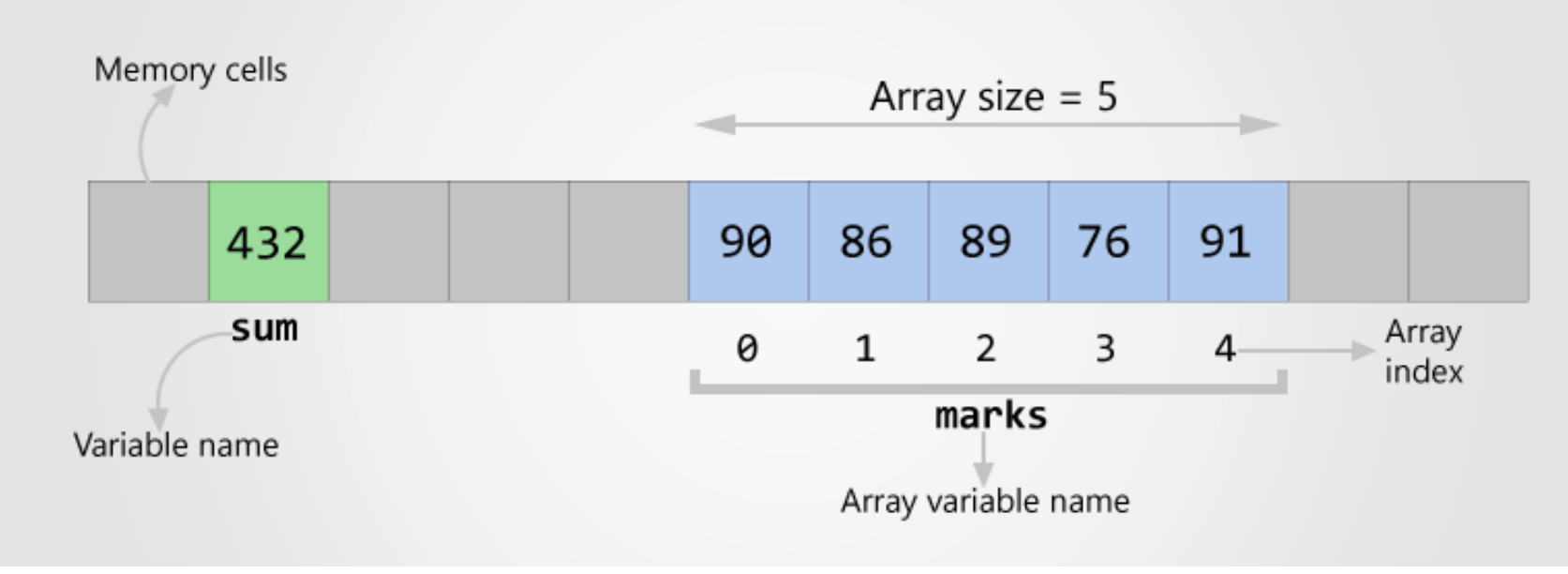
- The number of elements is finite and fixed !.
- Elements are stored in contiguous memory locations.



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- Use arrays instead of 25 different variables.

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- Assume test was for 25 marks.
- No negative marking.
- What are the possible different scores?
- Use arrays instead of ~~25~~ 26 different variables.

---

# Counting number of students who scored marks-i

```
#include<stdio.h>
main() {
     const int MAX_MARKS = 25;
     const int NUM_STUDENTS = 56;
     int marksCount[MAX_MARKS+1];

     int i, currMarks;
     for (i=1; i<= NUM_STUDENTS; i++) {
         printf("Enter the marks for Rollnumber %d\t", i);
         scanf("%d", &currMarks);
         marksCount[currMarks]++;
     }
}
```

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Is the program correct?

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          scanf("%d", &currMarks);
          marksCount[currMarks]++;
      }
}
```

Is the program correct?

- Initialization of `marksCount` missing.
- What if the user enters marks outside the range?

# Counting number of students who scored marks-i

```
#include<stdio.h>
int main() {
     const int MAX_MARKS = 25;
     const int NUM_STUDENTS = 5;
     int marksCount[MAX_MARKS+1];

     int i, currMarks;
     int sum;

     for (i=0; i<= MAX_MARKS; i++) {
         marksCount[i] = 0;
     }

     for (i=1; i<= NUM_STUDENTS; i++) {
         printf("Enter the marks for Rollnumber %d\t", i);
         scanf("%d", &currMarks);
         if (currMarks >= 0 && currMarks <= MAX_MARKS) {
            marksCount[currMarks]++;
         }
     }
```

# Initializing an array

Different ways of initializing array.

- int count[] = {10, 23, 50};
  Creates an array of 3 integers. count[0], count[1], count[2].
- int count[10] = {0};

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- int count[10] = {0};
- Using a loop to explicitly initialize the elements.

Common Mistake: Forgetting to initialize the elements of array.

# Evaluating a polynomial

$$P(x) = a_0 + a_1 x + a_2 x^2 + \ldots + a_n x^n$$

---

- $n$ is the degree of a polynomial.
- User provides $n$ coefficients.
- User provides the value of $x$ at which polynomial has to be evaluated.
- Evaluate the polynomial.

---

# Evaluating a polynomial

$$P(x) = a_0 + a_1 x + a_2 x^2 + \ldots + a_n x^n$$

- Evaluate each term separately.
  - $n$ additions.
  - $n + (n-1) + (n-2) + \ldots + 2 + 1 = \frac{n(n+1)}{2}$ multiplications.

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- $P(x) = a_0 + x(a_1 + x(a_2 + \cdots + x(a_{n-2} + x(a_{n-1} + xa_n))\ldots)$
  - $n$ additions.
  - $n$ multiplications.

# Evaluating a polynomial

```
#include <stdio.h>
#include <math.h>

int main() {
    int x, n, i;
    int coeff[20]; // maximum degree = 20.
    int value = 0;
    int product = 1;

    scanf("%d %d", &n, &x);

    for (i=0; i<=n; i++) {
        scanf("%d", &coeff[i]);
        product = coeff[i]* pow(x, i);
        value = value + product;
    }

    printf("%d\n", value);
    return 0;
}
```

# Evaluating a polynomial

```
#include<stdio.h>

main() {
    int x, n, i;
    int coeff[20]; // maximum degree = 20.
    int value;

    scanf("%d %d", &n, &x);

    for (i=0; i<=n; i++) {
        scanf("%d", &coeff[i]);
    }


    /* Fill in your code here */


    printf("%d\n", value);
}
```

# Evaluating a polynomial

# Character arrays

char name[20];

---

Different ways of initialization

- char name[20] = “Avani”;
- char name[20] = {‘A’, ‘V’, ‘A’, ‘N’, ‘I’, ’null char’};
- char name[20];
  scanf(“%s”, name);

# Character arrays

char name[20];

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Different ways of initialization

- char name[20] = “Avani”;
- char name[20] = {‘A’, ‘V’, ‘A’, ‘N’, ‘I’, ’null char’};
- char name[20];
  scanf(“%s”, name);
- char name[20];
  name = ”AVANI”; Incorrect!!

---

# What is the output of this program?

```
#include<stdio.h>
int main() {
    char name[20] = "AVANI";
    int i;

    for (i=10; i<20; i++) {
        name[i] = 'X';
    }

    printf("name = %s\n", name);

    for (i=0; i<20; i++) {
        printf("%c %d\n", name[i], name[i]);
    }
    return 0;
}
```

# Character arrays and standard library support

- Character arrays or strings occur very often.
- C provides a standard library string.h
- exposes several useful functions:
  - strlen
  - strcmp
  - strcpy
  - strstr

# Compare two strings

User input two strings $s1, s2$. Determine if $s1$ and $s2$ are the same.

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- if (s1 == s2) This does not work
- Write your own string compare.
- Assume strlen is available from string.h

# Palindromes

A string is a palindrome iff string == reverse(string)

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Write a program to determine if the given string is a palindrome.