

BATCH RECURSION AND C++

PROGRAMMING MASTERCLASS

AWESH ISLAM
BUET, CSE

Class-03

SHAROARE HOSAN EMON
BME , BUET

আমাদের সবগুলো ক্লাস দেখার জন্য ভিজিট করো
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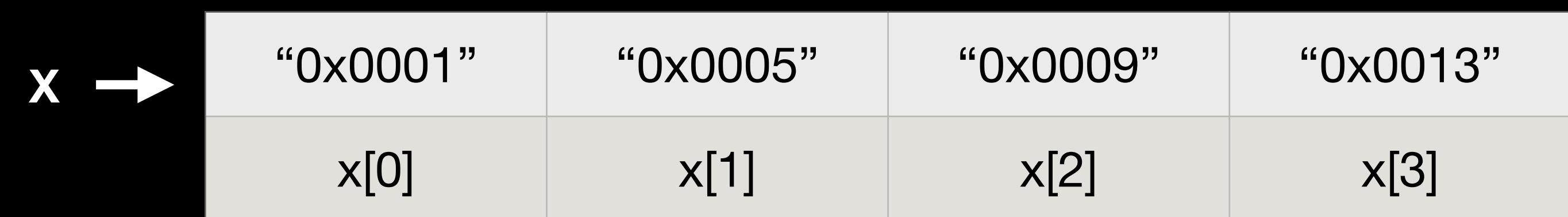
SCAN ME

Pointers Deep Dive

Relationship between array and pointers

```
1 #include <stdio.h>
2 int main() {
3     int x[4];
4     int i;
5
6     for(i = 0; i < 4; ++i) {
7         printf("&x[%d] = %p\n", i, &x[i]);
8     }
9
10    printf("Address of array x: %p", x);
11
12    return 0;
13 }
```

Relationship between array and pointers



Array Input with pointers

```
1 #include <stdio.h>
2 int main() {
3     int i, x[6],y[6];
4     printf("Enter 6 numbers for x: ");
5     for(i = 0; i < 6; i++) {
6         scanf("%d", &x[i]);
7     }
8     printf("Enter 6 numbers for y: ");
9     for(i = 0; i < 6; i++) {
10        scanf("%d", y+i);
11    }
12    for(int i = 0;i < 6; i++){
13        printf("%dth element of x: %d\n",i+1,x[i]);
14    }
15    for(int i = 0;i < 6; i++){
16        printf("%dth element of y: %d\n",i+1,y[i]);
17    }
18    return 0;
19 }
```

Access an array by dereferencing

```
1 #include <stdio.h>
2 int main() {
3     int i, x[6],y[6];
4     printf("Enter 6 numbers for x: ");
5     for(i = 0; i < 6; i++) {
6         scanf("%d", &x[i]);
7     }
8     printf("Enter 6 numbers for y: ");
9     for(i = 0; i < 6; i++) {
10        scanf("%d", y+i);
11    }
12    for(int i = 0;i < 6; i++){
13        printf("%dth element of x: %d\n",i+1,* (x+i));
14    }
15    for(int i = 0;i < 6; i++){
16        printf("%dth element of y: %d\n",i+1,* (y+i));
17    }
18    return 0;
19 }
```

Pointer Arithmetic of Arrays

```
1 #include <stdio.h>
2 int main() {
3
4     int x[5] = {1, 2, 3, 4, 5};
5     int* ptr;
6     ptr = &x[2];
7     printf("*ptr = %d \n", *ptr);
8     printf("*(ptr+1) = %d \n", *(ptr+1));
9     printf("*(ptr-1) = %d \n", *(ptr-1));
10
11    return 0;
12 }
```

Pointer Arithmetic of Strings: Quiz

Output কী হবে?

```
1 #include <stdio.h>
2 int main() {
3     char *str = "Bangladesh";           ⚠ ISO C++11 does not allow co
4     printf("%c, %c, %c, %c", *(str), *(str+1), *(str+2), *(str+3));
5     printf("%c, %c, %c, %c", *str, *str+1, *str+2, *str+3);
6 }
```

Pointer Arithmetic how it increases

```
1 #include <stdio.h>
2 int main() {
3     int *p, a = 10;
4     p = &a;
5     double *q, b = 10.5;
6     q = &b;
7     char *r, c = 'd';
8     r = &c;
9
10    printf("Size of int: %d byte\n", (int)sizeof(int));
11    printf("p : %p\n", p);
12    printf("p+1 : %p\n", p+1);
13    printf("p+2 : %p\n\n", p+2);
14
15    printf("Size of double: %d byte\n", (int)sizeof(double));
16    printf("q : %p\n", q);
17    printf("q+1 : %p\n", q+1);
18    printf("q+2 : %p\n\n", q+2);
19
20    printf("Size of char: %d byte\n", (int)sizeof(char));
21    printf("r : %p\n", r);
22    printf("r+1 : %p\n", r+1);
23    printf("r+2 : %p\n\n", r+2);
24 }
```

Void Pointers

```
1 #include <stdio.h>
2 int main() {
3     void *vp;
4     int n = 10;
5     vp = &n;
6     printf("Adress of n: %p\n",&n);
7     printf("Value of vp: %p\n",vp);
8
9     //Wrong
10    //printf("Content of vp: %d\n",*vp);
11
12    printf("Content of vp: %d\n",*((int *)vp));
13 }
```

Function Pointers

```
1 #include <stdio.h>
2
3 int add(int n1,int n2){
4     return n1 + n2;
5 }
6 int sub(int n1,int n2){
7     return n1 - n2;
8 }
9 int main(){
10     int(*fnc)(int,int);
11     int n1 = 10,n2 = 5;
12     fnc = &add;
13     printf("Result : %d\n",fnc(n1,n2));
14     fnc = &sub;
15     printf("Result : %d\n",fnc(n1,n2));
16 }
```

Passing Functions as Parameters

```
1 #include <stdio.h>
2
3 int add(int n1,int n2){
4     return n1 + n2;
5 }
6 int sub(int n1,int n2){
7     return n1 - n2;
8 }
9 int operate(int (*op)(int,int),int a,int b){
10    return op(a,b);
11 }
12 int main(){
13     int n1 = 10,n2 = 5;
14     printf("Result : %d\n",operate(&add,n1,n2));
15     printf("Result : %d\n",operate(&sub,n1,n2));
16 }
```

Passing Address as Parameters

Did not swap:
Wrong!!

```
1 #include <stdio.h>
2
3 void swap(int n1,int n2){
4     int temp = n1;
5     n1 = n2;
6     n2 = temp;
7 }
8 int main(){
9     int a = 10,b = 20;
10    swap(a, b);
11    printf("A is %d\n",a);
12    printf("B is %d\n",b);
13 }
```

```
A is 10
B is 20
Program ended with exit code: 0
```

Passing Address as Parameters

Swapped:
Success!!

```
1 #include <stdio.h>
2
3 void swap(int *n1,int *n2){
4     int temp = *n1;
5     *n1 = *n2;
6     *n2 = temp;
7 }
8 int main(){
9     int a = 10,b = 20;
10    swap(&a, &b);
11    printf("A is %d\n",a);
12    printf("B is %d\n",b);
13 }
```

```
A is 20
B is 10
Program ended with exit code: 0
```

Passing Address as Parameters: Quiz

What will be the Output?

```
1 #include <stdio.h>
2
3 void increment1(int n1){
4     n1++;
5 }
6 int increment2(int n1){
7     return n1++;
8 }
9 int increment3(int n1){
10    return ++n1;
11 }
12 void increment4(int *n1){
13     (*n1)++;
14 }
15 int main(){
16     int a = 10,b = 20,c = 30,d = 40;
17     increment1(a);
18     b = increment2(b);
19     c = increment3(c);
20     increment4(&d);
21     printf("A is %d\n",a);
22     printf("B is %d\n",b);
23     printf("C is %d\n",c);
24     printf("D is %d\n",d);
25 }
26 }
```

Scenario-১

তোমার স্কুল এ ক্লাস ১ এ ক্যাজন শিক্ষার্থী আছে তা তুমি জানো না চিচার এর কাছ থেকে
জেনে ইনপুট নিতে হবে ক্যাজন আছে এবং তাদের মার্কস।
তোমার চিচার এর জন্য একটি প্রোগ্রাম লিখে দাও।

Dynamic Memory Allocation

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int *marks;
5     int n;
6     printf("Please Enter the number of the students: ");
7     scanf("%d",&n);
8     marks = (int *) malloc(sizeof(int) * n);
9     printf("Enter mark of Each student: \n");
10    for(int i = 0;i < n;i++){
11        scanf("%d",&marks[i]);
12    }
13    printf("Marks of every student is printed below: \n");
14    for(int i = 0;i < n;i++){
15        printf("Number of student-%d is: | %d\n",i+1,marks[i]);
16    }
17 }
```

Free

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int *marks;
5     int n;
6     printf("Please Enter the number of the students: ");
7     scanf("%d",&n);
8     marks = (int *) malloc(sizeof(int) * n);
9     printf("Enter mark of Each student: \n");
10    for(int i = 0;i < n;i++){
11        scanf("%d",&marks[i]);
12    }
13    printf("Marks of every student is printed below: \n");
14    for(int i = 0;i < n;i++){
15        printf("Number of student-%d is: %d\n",i+1,marks[i]);
16    }
17    free(marks);
18 }
```

Scenario-২

তোমার স্কুল এ ক্লাস ১ থেকে ক্লাস ৫ পর্যন্ত কোন ক্লাস এ কয়জন শিক্ষার্থী আছে তা তুমি
জানো না চিচার এর কাছ থেকে জেনে ইনপুট নিতে হবে কয়জন আছে এবং তাদের মার্ক্স।
তোমার চিচার এর জন্য একটি প্রোগ্রাম লিখে দাও।

Solution

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int *marks[5];
5     int n[5];
6
7     for(int i = 0;i < 5;i++){
8         printf("Please Enter the number of the students in class %d: ",i+1);
9         scanf("%d",&n[i]);
10        marks[i] = (int *) malloc(sizeof(int) * n[i]);
11    }
12    for(int j = 0;j < 5;j++){
13        printf("Enter mark of Each student in class %d : \n",j+1);
14        for(int i = 0;i < n[j];i++){
15            scanf("%d",&marks[j][i]);
16        }
17    }
18    for(int j = 0;j < 5;j++){
19        printf("Marks of every student in class %d is printed below: \n",j+1);
20        for(int i = 0;i < n[j];i++){
21            printf("Number of student-%d is: %d\n",i+1,marks[j][i]);
22        }
23    }
24    for(int i = 0;i < 5;i++){
25        free(marks[i]);
26    }
27 }
```

Scenario-৩

তোমার স্কুল কোন ক্লাস পঞ্চাং আছে তাও তুমি জানো না এবং কোন ক্লাস এ কয়জন শিক্ষার্থী আছে তা তুমি জানো না চিচার এর কাছ থেকে জেনে ইনপুট নিতে হবে কয়টি ক্লাস আছে কোন ক্লাসে কয়জন আছে এবং তাদের মার্কস। তোমার চিচার এর জন্য একটি প্রোগ্রাম লিখে দাও।

Solution

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int **marks,num[12];
5     int classes;
6     printf("Enter the number of classes: \n");
7     scanf("%d",&classes);
8     marks = (int **)malloc(sizeof(int*)*classes);
9     for(int i = 0;i < classes;i++){
10         printf("Enter the number of students in class %d: \n ",i+1);
11         scanf("%d",&num[i]);
12         marks[i] = (int *)malloc(sizeof(int)*num[i]);
13     }
14     for(int i = 0;i < classes;i++){
15         printf("Enter the marks of students in class %d: \n",i+1);
16         for(int j = 0; j < num[i]; j++){
17             scanf("%d",&marks[i][j]);
18         }
19     }
20     for(int i = 0;i < classes;i++){
21         printf("The marks of class %d is: \n",i+1);
22         for(int j = 0;j < num[i];j++){
23             printf("%d ",marks[i][j]);
24         }
25         printf("\n");
26     }
27     for(int i = 0;i < classes;i++){
28         free(marks[i]);
29     }
30     free(marks);
31 }
```

Calloc

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int *marks,n;
5     printf("Enter the number of students: ");
6     scanf("%d",&n);
7     marks = (int *) calloc(n, sizeof(int));
8     for(int i = 0;i < n;i++){
9         printf("Enter the number of %d student: ",i+1);
10        scanf("%d",&marks[i]);
11    }
12    for(int i = 0;i < n;i++){
13        printf("The number of %d student is: %d\n",i+1,marks[i]);
14    }
15 }
```

Realloc

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int *marks,n;
5     printf("Enter the number of students: ");
6     scanf("%d",&n);
7     marks = (int *) calloc(n, sizeof(int));
8     for(int i = 0;i < n;i++){
9         printf("Enter the number of %d student: ",i+1);
10        scanf("%d",&marks[i]);
11    }
12    for(int i = 0;i < n;i++){
13        printf("The number of %d student is: %d\n",i+1,marks[i]);
14    }
15    printf("Enter the number of students in next class:");
16    scanf("%d",&n);
17    marks = (int *) realloc(marks, sizeof(int)*n);
18    for(int i = 0;i < n;i++){
19        printf("Enter the number of %d student: ",i+1);
20        scanf("%d",&marks[i]);
21    }
22    for(int i = 0;i < n;i++){
23        printf("The number of %d student is: %d\n",i+1,marks[i]);
24    }
25 }
```

Pointer arithmetic advanced

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int **ara;
5     int row,col;
6     printf("Enter the row: ");
7     scanf("%d",&row);
8     printf("Enter the column: ");
9     scanf("%d",&col);
10    ara = (int **) malloc(sizeof(int *)*row);
11    for(int i = 0;i < row;i++){
12        ara[i] = (int *)malloc(sizeof(int)*col);
13    }
14    for(int i = 0;i < row;i++){
15        for(int j = 0;j < col;j++){
16            scanf("%d",&ara[i][j]);
17        }
18    }
19    for(int i = 0;i < row;i++){
20        for(int j = 0;j < col;j++){
21            printf("%d ",*(ara+i)+j));
22        }
23    }
24 }
25 }
```

Pointer arithmetic advanced

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 int main(){
4     int arr[3][3] = {{1,2,3},{4,5,6},{7,8,9}};
5     printf("arr+7 is %d\n",arr+7);
6     printf("*(arr+4) is %d\n",*(arr+4));
7     printf("**(arr+1) is %d\n",**(arr+1));
8     printf("*(*(arr+2)+1) is %d\n",*(*(arr+2)+1));
9     printf("*(*(arr+1)+4) is %d\n",*(*(arr+1)+4));
10 }
```

```
**arr is 8
*(arr+4) is 5
**(arr+1) is 4
*(*(arr+2)+1) is 8
*(*(arr+1)+4) is 8
Program ended with exit code: 0
```