

Advanced Programming (C++)

From C to C++

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<http://yoosofan.github.io/course/cpp.html>

Methods of Learning a Programming Language

- Just using tools, packages, libraries, prepared functions, prepared classes, and objects.
 1. Using simplified data type with a lot of overhead like vector, string, and etc.
 2. algorithm
 3. Using other libraries without knowing how they develop
 4. Always searching for new tools, language, packages, etc.
 5. Consider most language similar
 6. More tools, packages, languages, and alike means a better programmer
 7. Shallow understanding of the concept of each language and its basis
- Deeply learn the foundation of the language of the essential aspect of a language
 1. Step by Step learning of the language by writing programs
 2. Using basis to make new tools instead of using other tools
 3. Preparing for writing more sophisticated programs
 4. Deep understanding of each tool/package/library/etc.
 5. Learning and using the best tool based on the application requirement

Converting C code to C++

1. Rename .c file to .cpp

2. <stdio.h> to <cstdio>

- stdio.h → cstdio
- math.h → cmath
- stdlib.h → cstdlib
- string.h → cstring
- ctype.h → cctype

- [Wikipedia](#)
- [cppreference](#)
- Add the following line after includes
 - using namespace std;
- Compile using C++ compiler like g++

```
1 #include<stdio.h>
2 int main(){
3     int s1, s2, s3, sum;
4     printf("Enter mark\n");
5     scanf("%d", &s1 );
6     printf("Enter mark\n");
7     scanf("%d", &s2 );
8     printf("Enter mark\n");
9     scanf("%d", &s3 );
10    sum = s1 + s2 + s3;
11    printf("%d\n", sum);
12    return 0;
13 }
```

```
1 #include<cstdio>
2 using namespace std;
3 int main(){
4     int s1, s2, s3, sum;
5     printf("Enter mark\n");
6     scanf("%d", &s1);
7     printf("Enter mark\n");
8     scanf("%d", &s2);
9     printf("Enter mark\n");
10    scanf("%d", &s3);
11    sum = s1 + s2 + s3;
12    printf("%d\n", sum);
13    return 0;
14 }
```

```

1 #include<stdio.h>
2 #include<math.h>
3 #include<stdlib.h>
4
5 int main(){
6     int i=1,a=2,b,c=3;
7     b = i>a ? a>c ? c:a : i>c?c:i;
8     printf("%d\t",b);
9     printf("%d\n", i>a ? a>c?c:a : i>c?c:i);
10    b=1;a=2;c=1;
11    printf("%d\t",b+=a+=c);
12    printf("%d,%d,%d\n",b,a,c);
13    printf("%d\n",printf("%d\n",b));
14    printf("%lf\n",sin(0.12));
15    printf("%d\n",abs(-12));
16    printf("%lf\n",fabs(-0.12));
17    printf("%lf\n",pow(2,4));
18    printf("%lf\n",sqrt(2));
19    printf("%lf\n",pow(2,0.5));
20    i=2;a=3;b=4;
21    i= a,b; /* */
22    printf("%d\t",i);
23    return 0;
24 }

```

```

1 #include<cstdio>
2 #include<cmath>
3 #include<cstdlib>
4 using namespace std;
5 int main(){
6     int i=1,a=2,b,c=3;
7     b = i>a ? a>c ? c:a : i>c?c:i;
8     printf("%d\t",b);
9     printf("%d\n", i>a ? a>c?c:a : i>c?c:i);
10    b=1;a=2;c=1;
11    printf("%d\t",b+=a+=c);
12    printf("%d,%d,%d\n",b,a,c);
13    printf("%d\n",printf("%d\n",b));
14    printf("%lf\n",sin(0.12));
15    printf("%d\n",abs(-12));
16    printf("%lf\n",fabs(-0.12));
17    printf("%lf\n",pow(2,4));
18    printf("%lf\n",sqrt(2));
19    printf("%lf\n",pow(2,0.5));
20    i=2;a=3;b=4;
21    i= a,b; /* */
22    printf("%d\n",i);
23 }

```

```

1 #include<stdio.h> /* ./a.out >a1.txt */
2 int min(int, int); int input(void);
3 void myf(void); void printTriangle(void);
4 void printSquare(void); void menu(void);
5 int main(){
6     menu();
7     return 0;
8 }
9 void menu(void){ int n;
10     do{
11         printf("Enter your choice. \
12             Enter 4 for end\n");
13         n=input();
14         if(n==1) myf();
15         else if(n==2)printTriangle();
16         else if(n==3)printSquare();
17         else if(n!=4)printf("wrong number\n");
18     }while(n!=4);
19 }
20 void printSquare(void){
21     int n,i,j; n=input();
22     for(i=0;i<n;i++){
23         for(j=0;j<n;j++) printf("*");
24         printf("\n");
25     }
26 }
27 void printTriangle(void){

```

```

1 #include<cstdio> /* ./a.out >a1.txt */
2 using namespace std;
3 int min(int, int); int input(void);
4 void myf(void); void printTriangle(void);
5 void printSquare(void); void menu(void);
6 int main(){
7     menu();
8     return 0;
9 }
10 void menu(void){int n;
11     do{
12         printf("Enter your choice. \
13             Enter 4 for end\n");
14         n=input();
15         if(n==1) myf();
16         else if(n==2)printTriangle();
17         else if(n==3)printSquare();
18         else if(n!=4)printf("wrong number\n");
19     }while(n!=4);
20 }
21 void printSquare(void){
22     int n,i,j; n=input();
23     for(i=0;i<n;i++){
24         for(j=0;j<n;j++) printf("*");
25         printf("\n");
26     }
27 }

```

```

27 void printTriangle(void){
28     int n,i,j; n=input();
29     for(i=0;i<n;i++){
30         for(j=0;j<=i;j++) printf("*");
31         printf("\n");
32     }
33 }
34 int min(int a, int b){return a<b ? a:b;}
35 int input(void){int a;
36     do{
37         printf("Enter a>0: ");
38         scanf("%d",&a);
39     }while(a<=0);
40     return a;
41 }
42 void myf(void){
43     int a=input(), b=input();
44     printf("min %d\n",min(a,b));
45 }

```

```

27 }
28 void printTriangle(void){
29     int n,i,j; n=input();
30     for(i=0;i<n;i++){
31         for(j=0;j<=i;j++) printf("*");
32         printf("\n");
33     }
34 }int min(int a, int b){return a<b ? a : b;}
35 int input(void){int a;
36     do{
37         printf("Enter a>0: ");
38         scanf("%d",&a);
39     }while(a<=0);
40     return a;
41 }void myf(void){
42     int a=input(), b=input();
43     printf("min %d\n",min(a,b));
44 }

```

No return 0 and void

```
1 #include<stdio.h>
2 //c2cpp02_functions_style.cpp
3 int min(int, int);
4 int input();
5 void myf();
6 void printTriangle();
7 void printSquare();
8
9 int main(){
10     int n = 0;
11     do{
12         printf("Enter your choice. \
13             Enter 4 for end\n");
14         n = input();
15         if(n == 1)
16             myf();
17         else if(n == 2)
18             printTriangle();
19         else if(n == 3)
20             printSquare();
21         else if(n != 4)
22             printf("wrong number\n");
23     }while(n != 4);
24 }
```

```
25 void printSquare(void){
26     int n, i = 0, j;
27     n = input();
28     for(i = 0; i < n; i++){
29         for(j = 0; j < n; j++){
30             printf("*");
31             printf("\n");
32         }
33     }
34
35 void printTriangle(){
36     int n, i, j;
37     n = input();
38     for(i = 0; i < n; i++){
39         for(j = 0; j <= i; j++){
40             printf("*");
41             printf("\n");
42         }
43     }
44
45 int min(int a, int b)
46 {return a < b ? a : b;}
```


Online Compilers and tools

- http://www.tutorialspoint.com/compile_c_online.php
- <http://cpp.sh/>
- <https://godbolt.org> , <https://github.com/compiler-explorer>
- <https://cppinsights.io>
- <http://codepad.org/>
- <https://www.jdoodle.com/c-online-compiler>
- <http://ideone.com>
- <https://www.codechef.com/ide>
- <http://webcompiler.cloudapp.net/>
- <https://codepad.remoteinterview.io/GladnessUrgentCactusCostume>
- <http://www.onlinecompiler.net/>
- <http://getprogramcode.com/compiler/compile-c-programs-online.html>
- <http://coliru.stacked-crooked.com/>
- <https://ide.geeksforgeeks.org/>
- https://www.onlinegdb.com/online_c_compiler
- <https://www.remoteinterview.io/online-c-compiler>
- http://www.compileonline.com/compile_c_online.php
- <https://www.codechef.com/ide>
- <https://www.beta.browxy.com/>
- compiler.run

Compilers

- gcc(g++): <http://gcc.gnu.org>
 - windows:
 - <https://www.mingw-w64.org/downloads/>
 - <http://win-builds.org/doku.php>
 - <https://www.msys2.org/#installation>
- clang
- <https://visualstudio.microsoft.com/downloads/>

Compile and run

```
cd folder_of_code  
g++ code1.cpp  
./a.out
```

```
cd folder_of_code  
g++ code1.cpp -o code1.o  
./code1.o
```

Editors

- geany: <http://www.geany.org>
- notepad++ <http://www.notepad-plus-plus.org>
- kate <http://kate-editor.org>
- <https://code.visualstudio.com/download>

git

- <https://git-scm.com/>
- <https://github.com/yoosofan/slide>
- https://gitlab.com/yoosofan_course/Farsi_gitlab_guide

```
git config --global user.name "نام و نام خانوادگی شما"  
git config --global user.email "رایا نامی شما"
```

```
git clone https://github.com/yoosofan/slide.git
```

```
cd slide  
git pull origin main
```

IDE

- <https://zed.dev/>
- orwelldevcpp: <http://sourceforge.net/projects/orwelldevcpp>
- codeblocks: <http://www.codeblocks.org>
- Ch: <http://www.softintegration.com>
- Qt Creator: <http://qt-project.org>
- kdevelop <https://apps.kde.org/kdevelop/>
- cbuilder: <http://www.embarcadero.com/products/cbuilder>
- DevCpp: <http://www.bloodshed.net/devcpp.html>
- Visual Studio Express: <http://www.microsoft.com/visualstudio/eng/products/visual-studio-express-products>
- xcode: <https://developer.apple.com/xcode/>

Standard Library

- https://en.wikipedia.org/wiki/C_standard_library
- https://www.tutorialspoint.com/c_standard_library/index.htm
- https://en.wikibooks.org/wiki/C_Programming/Standard_libraries
- <https://en.cppreference.com/w/c/header>

C++

- https://en.wikipedia.org/wiki/C%2B%2B_Standard_Library
- <https://en.wikipedia.org/wiki/C%2B%2B>
- https://en.wikipedia.org/wiki/C%2B%2B_Standard_Library
- <https://www.programiz.com/cpp-programming/library-function>
- <https://en.cppreference.com/w/cpp/header>
- https://www.tutorialspoint.com/cpp_standard_library/index.htm

Initialization and Assignment

```
1 #include<stdio.h>
2 /*#include<iostream>
3 using namespace std;*/
4 int main(){
5     int s1 = 2;
6     // int sum = s1+4;
7     printf("Enter mark\n");
8     scanf("%d",& s1 );
9     /*cout << "sss" ;*/
10    int s2;
11    printf("Enter mark\n");
12    scanf("%d",& s2 );
13    int s3;
14    printf("Enter mark\n");
15    scanf("%d",& s3 );
16    // static int sum= s1 + s2 + s3; // error
17    const int m1=2, m2=3, m3=4;
18    static int sum= m1 + m2 + m3;
19    // Assignment
20    printf("%d\n",sum);
21 }
```

```
1 #include<cstdio>
2 using namespace std;
3 int main(){
4     int s1;
5     printf("Enter mark\n");
6     scanf("%d",& s1 );
7     int s2;
8     printf("Enter mark\n");
9     scanf("%d",& s2 );
10    int s3;
11    printf("Enter mark\n");
12    scanf("%d",& s3 );
13    int sum;
14    sum = s1 + s2 + s3;
15    // Assignment
16    printf("%d\n",sum);
17 }
```

const instead of define

```
1 #include<stdio.h>
2 /*#include<iostream>
3 using namespace std;*/
4 int f1(const int m1);
5 # define m33 50
6 const int global_variable_m44 = 50;
7 int main(){
8     int s1 = 2;
9     int arr[50];
10    int i;
11    for(i=0; i< 50; i++)
12        arr[i] = i*2;
13    int arr2[m33];
14    for(i=0; i< m33; i++)
15        arr2[i] = i*2;
16    int arr3[global_variable_m44];
17    for(i=0; i< global_variable_m44; i++)
18        arr2[i] = i*2;
19    // int sum = s1+4;
20    printf("Enter mark\n");
```

```
20    scanf("%d",& s1 );
21    /*cout << "sss" ;*/
22    int s2;
23    printf("Enter mark\n");
24    scanf("%d",& s2 );
25    int s3;
26    printf("Enter mark\n");
27    scanf("%d",& s3 );
28    // static int sum= s1 + s2 + s3; // error
29    const int m1=2, m2=3, m3=4;
30    static int sum= m1 + m2 + m3;
31    // Assignment
32    printf("%d\n",sum);
33    printf("%d\n",f1(m2));
34 }
35 int f1(const int m1){
36     static int sum = 5;
37     sum = 5;
38     return sum++ + m1;
39 }
```


Cin & cout

```
1 #include<iostream>
2 using namespace std;
3 int main(){
4     int s1;
5     cout << "Enter mark\n";
6     cin >> s1 ;
7     int s2;
8     cout << "Enter mark\n";
9     cin >> s2;
10    cout << "Enter mark\n";
11    int s3;
12    cin >> s3 ;
13    int sum = s1 + s2 + s3;
14    // initialization
15    cout << sum;
16 }
```

```
1 #include<iostream>
2 int main(){
3     int s1;
4     std::cout << "Enter mark\n";
5     std::cin >> s1 ;
6     int s2;
7     std::cout << "Enter mark\n";
8     std::cin >> s2;
9     std::cout << "Enter mark\n";
10    int s3;
11    std::cin >> s3 ;
12    int sum = s1 + s2 + s3;
13    // initialization
14    std::cout << sum;
15 }
```

Struct name C

```

2 struct firstStruct{ };
3 struct secondStruct{ };
4 struct thirdStruct{ };
5 struct firstStruct f1(void);
6 void f2(struct firstStruct);
7 int main(){
8     struct firstStruct myfs;
9     myfs = f1();
10    f2(myfs);
11    return 0;
12 }
13 struct firstStruct f1(void){
14     struct firstStruct fs1;
15     struct secondStruct ssl;
16     struct thirdStruct ts1;
17     return fs1;
18 }
19 void f2(struct firstStruct m1){
20     printf("%p\n", &m1);
21 }

```

Struct name C++

```

2 struct firstStruct{ };
3 struct secondStruct{ };
4 struct thirdStruct{ };
5 firstStruct f1(void);
6 void f2(firstStruct);
7 int main(){
8     firstStruct myfs;
9     myfs = f1();
10    f2(myfs);
11 }
12 firstStruct f1(){
13     firstStruct fs1;
14     secondStruct ssl;
15     thirdStruct ts1;
16     return fs1;
17 }
18 void f2(firstStruct m1){
19     cout << &m1 ;
20     cout << "\n";
21 }

```

```

2 struct date{ int year, month, day; };
3 struct student{
4     char name[50];
5     char stdNumber[15];
6     struct date birthDate;
7 };
8 struct date input_date(void);
9 struct student input_student(void);
10 void print_date(struct date d1);
11 void print_student(struct student st);
12 int main(){
13     struct student st1[50];
14     int n, i=0;
15     printf("Enter number of \
16           students(0<n<50) ");
17     scanf("%d",&n);
18     if(n>0 && n<50)
19         do{
20             st1[i] = input_student();
21             print_student(st1[i]);
22             i++;
23         }while(i<n);
24     else printf("0<n<50, %d",n);
25 }
26 struct date input_date(void){
27     struct date d1;

```

```

3 struct date{ int year, month, day; };
4 struct student{
5     char name[50];
6     char stdNumber[15];
7     date birthDate;
8 };
9 date input_date(void);
10 student input_student(void);
11 void print_date(date d1);
12 void print_student(student st);
13 int main(){
14     student st1[50];
15     int n, i=0;
16     cout << "Enter number of students(0<n<50) ";
17     cin >> n;
18     if(n>0 && n<50)
19         do{
20             st1[i] = input_student();
21             print_student(st1[i]);
22             i++;
23         }while(i<n);
24     else { cout << "0<n<50 "; cout << n;}
25 }
26 date input_date(void){
27     date d1;
28     cout << "Enter year:{1350..1390} ";

```

```

28  printf("Enter year:{1350..1390} ");
29  scanf("%d",&d1.year);
30  printf("Enter month{1..12}:");
31  scanf("%d",&d1.month);
32  printf("Enter day{1..31}:");
33  scanf("%d",&d1.day);
34  return d1;
35 }
36 void print_date(struct date d1){
37     printf("year=%d,\tmonth=%d,\tday=%d\n",
38         d1.year,d1.month,d1.day);
39 }
40 struct student input_student(void){
41     struct student st;
42     printf("Enter name :");
43     scanf("%s",st.name);
44     printf("Enter studnet number :");
45     scanf("%s",st.stdNumber);
46     printf("Enter birth date :");
47     st.birthDate = input_date();
48     return st;
49 }
50 void print_student(struct student st){
51     printf("name=%s\n",st.name);
52     printf("number=%s\n",st.stdNumber);
53     print_date(st.birthDate);
54 }

```

```

29  cin >> d1.year;
30  cout << "Enter month{1..12}:";
31  cin >> d1.month;
32  cout << "Enter day{1..31}:";
33  cin >> d1.day;
34  return d1;
35 }
36 void print_date(date d1){
37     cout << "year = "; cout << d1.year;
38     cout << "\tmonth = "; cout << d1.month;
39     cout << "\tday = ";
40     cout << d1.day; cout << "\n";
41 }
42 student input_student(void){
43     student st;
44     cout << "Enter name :";
45     cin >> st.name;
46     cout << "Enter studnet number :";
47     cin >> st.stdNumber;
48     cout << "Enter birth date :";
49     st.birthDate = input_date();
50     return st;
51 }
52 void print_student(student st){
53     cout << "name = "; cout << st.name;
54     cout << "\n"; cout << "number = ";
55     cout << st.stdNumber; cout << "\n";
56     print_date(st.birthDate);
57 }

```

```

1  printf("Enter year:{1350..1390} ");
2  scanf("%d",&d1.year);
3  printf("Enter month{1..12}:");
4  scanf("%d",&d1.month);
5  printf("Enter day{1..31}:");
6  scanf("%d",&d1.day);
7  return d1;
8 }
9 void print_date(struct date d1){
10     printf("year=%d,\tmonth=%d,\tday=%d\n",
11         d1.year,d1.month,d1.day);
12 }
13 struct student input_student(void){
14     struct student st;
15     printf("Enter name :");
16     scanf("%s",st.name);
17     printf("Enter studnet number :");
18     scanf("%s",st.stdNumber);
19     printf("Enter birth date :");
20     st.birthDate = input_date();
21     return st;
22 }
23 void print_student(struct student st){
24     printf("name=%s\n",st.name);
25     printf("number=%s\n",st.stdNumber);
26     print_date(st.birthDate);
27 }

```

```

1  cout << "Enter year:{1350..1390} ";
2  cin >> d1.year;
3  cout << "Enter month{1..12}:";
4  cin >> d1.month;
5  cout << "Enter day{1..31}:";
6  cin >> d1.day;
7  return d1;
8 }
9 void print_date(date d1){
10     cout << "year = "; cout << d1.year;
11     cout << "\tmonth = "; cout << d1.month;
12     cout << "\tday = ";
13     cout << d1.day; cout << "\n";
14 }
15 student input_student(void){
16     student st;
17     cout << "Enter name :";
18     cin >> st.name;
19     cout << "Enter studnet number :";
20     cin >> st.stdNumber;
21     cout << "Enter birth date :";
22     st.birthDate = input_date();
23     return st;
24 }
25 void print_student(student st){
26     cout << "name = "; cout << st.name;
27     cout << "\n"; cout << "number = ";
28     cout << st.stdNumber; cout << "\n";
29     print_date(st.birthDate);
30 }

```

simple cout (print_date)

```

1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} ";
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = "; cout << d1.year;
16     cout << "\tmonth = "; cout << d1.month;
17     cout << "\tday = "; cout << d1.day; cout << "\n";
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22     return 0;
23 }

```

multiple output (print_date)

```

1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} " ;
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = " << d1.year;
16     cout << "\tmonth = " << d1.month;
17     cout << "\tday = " << d1.day << "\n";
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22     return 0;
23 }

```

simple cout (print_date)

```
1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} " ;
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = " << d1.year;
16     cout << "\tmonth = " << d1.month;
17     cout << "\tday = " << d1.day << "\n";
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22     return 0;
23 }
```

multiple output (print_date)

```
1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} " ;
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = " << d1.year
16         << "\tmonth = " << d1.month
17         << "\tday = " << d1.day << "\n";
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22 }
```


\n

endl

```
1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} " ;
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = " << d1.year
16         << "\tmonth = " << d1.month
17         << "\tday = " << d1.day << "\n";
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22 }
```

```
1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void){
5     date d1;
6     cout << "Enter year:{1350..1390} " ;
7     cin >> d1.year;
8     cout << "Enter month{1..12}:";
9     cin >> d1.month;
10    cout << "Enter day{1..31}:";
11    cin >> d1.day;
12    return d1;
13 }
14 void print_date(date d1){
15     cout << "year = " << d1.year
16         << "\tmonth = " << d1.month
17         << "\tday = " << d1.day << endl;
18 }
19 int main(){
20     date birthDate = input_date();
21     print_date(birthDate);
22     return 0;
23 }
```

```

1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void);
5 void print_date(date d1);
6 void print(int k){cout << k << endl;}
7 int input(void)
8 {int n; cout <<"Enter n "; cin >> n; return n;}
9 int main(){
10     date d1;
11     d1 = input_date();
12     print_date(d1);
13 }
14 date input_date(void){
15     date d1;
16     cout << "Enter year:{1350..1390} ";
17     cin >> d1.year;
18     cout << "Enter month{1..12}:";
19     cin >> d1.month;
20     cout << "Enter day{1..31}:";
21     cin >> d1.day;
22     return d1;
23 }
24 void print_date(date d1){
25     cout << "year = " << d1.year;
26     cout << "\tmonth = " << d1.month;
27     cout << "\tday = " << d1.day << endl;
28 }

```

```

1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input_date(void);
5 void print(date d1);
6 void print(int k){cout << k << endl;}
7 int input(void)
8 {int n; cout <<"Enter n "; cin >> n; return n;}
9 int main(){
10     date d1;
11     d1 = input_date();
12     print(d1);
13 }
14 date input_date(void){
15     date d1;
16     cout << "Enter year:{1350..1390} ";
17     cin >> d1.year;
18     cout << "Enter month{1..12}:";
19     cin >> d1.month;
20     cout << "Enter day{1..31}:";
21     cin >> d1.day;
22     return d1;
23 }
24 void print(date d1){
25     cout << "year = " << d1.year;
26     cout << "\tmonth = " << d1.month;
27     cout << "\tday = " << d1.day << endl;
28 }

```

```

1 #include<iostream>
2 using namespace std;
3 struct date{ int year, month, day; };
4 date input(void);
5 void print(date d1);
6 void print(int k){cout << k << endl;}
7 int input(void)
8 {int n; cout <<"Enter n "; cin >> n; return n;}
9 int main(){
10     date d1;
11     d1 = input();
12     print(d1);
13 }
14 date input(void){
15     date d1;
16     cout << "Enter year:{1350..1390} ";
17     cin >> d1.year;
18     cout << "Enter month{1..12}:";
19     cin >> d1.month;
20     cout << "Enter day{1..31}:";
21     cin >> d1.day;
22     return d1;
23 }
24 void print(date d1){
25     cout << "year = " << d1.year;
26     cout << "\tmonth = " << d1.month;
27     cout << "\tday = " << d1.day << endl;
28 }

```

```

1 7:5: error: ambiguating new declaration of
2     7 | int input(void)
3       |     ^~~~~
4 :4:6: note: old declaration 'date input()'
5     4 | date input(void);
6       |     ^~~~~
7 Compilation failed.

```

function default values

```
void point(int x = 3, int y = 4);
```

```
point(1,2); // calls point(1,2)
```

```
point(1);   // calls point(1,4)
```

```
point();    // calls point(3,4)
```

```
int sum(int x, int y, int z=0, int w=0)
```

```
{
```

```
    return (x + y + z + w);
```

```
}
```

```
/* Driver program to test above function*/
```

```
int main()
```

```
{
```

```
    cout << sum(10, 15) << endl;
```

```
    cout << sum(10, 15, 25) << endl;
```

```
    cout << sum(10, 15, 25, 30) << endl;
```

```
}
```

- https://en.cppreference.com/w/cpp/language/default_arguments
- <https://www.geeksforgeeks.org/default-arguments-c/>

Errors Default value for parameters(I)

```
1 #include<iostream>
2 using namespace std;
3
4 int sum(int x, int y, int z=0, int w){
5     return (x + y + z + w);
6 }
7
8 int main(){
9     cout << sum(10, 15) << endl;
10    cout << sum(10, 15, 25) << endl;
11    cout << sum(10, 15, 25, 30) << endl;
12 }
```

```
4:36: error: default argument missing for parameter 4 of 'int sum(int, int, int, int)'
4 | int sum(int x, int y, int z=0, int w){
  |                               ~~~~^
4:27: note: ...following parameter 3 which has a default argument
4 | int sum(int x, int y, int z=0, int w){
  |               ~~~~^~~
```

Errors Default value for parameters(II)

```
1 #include<iostream>
2 using namespace std;
3 int sum(int x, int y, int z=0, int w=0){
4     return (x + y + z + w);
5 }
6 int sum(int x, int y){
7     return (x + y);
8 }
9 int main(){
10     cout << sum(10, 15) << endl;
11     cout << sum(10, 15, 25) << endl;
12     cout << sum(10, 15, 25, 30) << endl;
13 }
```

```
1 10:21: error: call of overloaded 'sum(int, int)' is ambiguous
2     10 |     cout << sum(10, 15) << endl;
3         |               ^
4 3:5: note: candidate: 'int sum(int, int, int, int)'
5     3 | int sum(int x, int y, int z=0, int w=0){
6         |     ^~~
7 6:5: note: candidate: 'int sum(int, int)'
8     6 | int sum(int x, int y){
9         |     ^~~
```

Object Oriented, Encapsulation(I)

- Functions in Struct
- Object Oriented Programming
- Methods (Functions in struct)

```

3 struct student{
4     char name[20];
5     int id;
6     char address[50];
7 };
8 student input_student(){
9     student s1;
10    cout << "Enter name:";
11    cin >> s1.name;
12    cout << "id:";
13    cin >> s1.id;
14    cout << "address:";
15    cin >> s1.address;
16    return s1;
17 }
18 void print(student st1){
19     cout << "name:\t\t"
20         << st1.name << endl;
21     cout << "id:\t\t"
22         << st1.id << endl;
23     cout << "address:\t\t"
24         << st1.address << endl;
25 }
26 int main(){
27     student st1;
28     st1 = input_student();
29     print(st1);
30     student st2;
31     st2 = input_student();
32     print(st2);
33 }

```

```

3 struct student{
4     char name[20];
5     int id;
6     char address[50];
7
8     void input(){
9         cout << "Enter name:";
10        cin >> name;
11        cout << "id:";
12        cin >> id;
13        cout << "address:";
14        cin >> address;
15    }
16
17    void print(){
18        cout << "name:\t\t"
19            << name << endl;
20        cout << "id:\t\t"
21            << id << endl;
22        cout << "address:\t\t"
23            << address << endl;
24    }
25 };
26 int main(){
27     student std;
28     std.input();
29     std.print();
30     student st2;
31     st2.input();
32     st2.print();
33 }

```


Encapsulation(II)

```
3 struct date{ int year, month, day; };
4 date input(){
5     date d1;
6     cout << "Year: ";
7     cin >> d1.year;
8     cout << "Month: ";
9     cin >> d1.month;
10    cout << "Day: ";
11    cin >> d1.day;
12    return d1;
13 }
14 void print(date d1){
15     cout << d1.year << '/' << d1.month
16         << '/' << d1.day << endl;
17 }
18 int main(){
19     date d1;
20     d1 = input();
21     print(d1);
22     date d2;
23     d2 = input();
24     print(d2);
25 }
```

```
3 struct date{
4     int year, month, day;
5     void input(){
6         cout << "Year: ";
7         cin >> year;
8         cout << "Month: ";
9         cin >> month;
10        cout << "Day: ";
11        cin >> day;
12    }
13    void print(){
14        cout << year << '/' << month
15            << '/' << day << endl;
16    }
17 };
18 int main(){
19     date d1;
20     d1.input();
21     d1.print();
22     date d2;
23     d2.input();
24     d2.print();
25 }
```

Encapsulation(III)

```
3 struct point {double x, y;};
4 point inputPoint() {
5     point p1;
6     cout << "Enter the X value: ";
7     cin >> p1.x;
8     cout << "Enter the Y value: ";
9     cin >> p1.y;
10    return p1;
11 }
12 void print(point p1) {
13     cout << "X value: "
14         << p1.x << endl;
15     cout << "Y value: "
16         << p1.y << endl;
17 }
18 point move(point p1,
19             double dx, double dy) {
20     p1.x += dx;
21     p1.y += dy;
22     return p1;
23 }
24 int main(){
25     point p1 = inputPoint();
26     print(p1);
27 }
```

```
3 struct point{
4     double x, y;
5
6     void input() {
7         cout << "Enter the X value: ";
8         cin >> x;
9         cout << "Enter the Y value: ";
10        cin >> y;
11    }
12    void print() {
13        cout << "X value: "
14            << x << endl;
15        cout << "Y value: "
16            << y << endl;
17    }
18    void move(double dx, double dy){
19        x += dx;
20        y += dy;
21    }
22 };
23 int main(){
24     point p1;
25     p1.input();
26     p1.print();
27 }
```

Encapsulation(IV)

```
3 struct complexCls{
4     double re,img;
5     void setRe(double r)
6     {re=r;}
7     void setImg(double i)
8     {img=i;}
9     double getRe(void)
10    {return re;}
11    double getImg(void)
12    {return img;}
13 };
14 void f1(){
15     complexCls c1;
16     c1.re=12;
17     c1.setRe(12);
18     c1.setImg(4);
19     cout << c1.getRe() << endl;
20 }
21 int main(){f1();}
```

```
3 struct complexCls{
4     double re,img;
5     void setRe(double r)
6     {re=r;}
7     void setImg(double i)
8     {img=i;}
9     double getRe(void)
10    {return re;}
11    double getImg(void)
12    {return img;}
13
14    void set(double r=0, double i=0)
15    {re = r; img = i;}
16 };
17 void f1(void){
18     complexCls c1;
19     c1.set(12,14);
20     cout << c1.getRe() << endl;
21 }
22 int main(){f1();}
```

Attribute Default Value(I)

```
3 struct complexCls{
4     double re, img; // No Default
5     void set(double r = 0, double i = 0)
6     { re = r; img = i;}
7     void print(){
8         cout << '(' << re << ','
9             << img << ')' << endl;
10    }
11    void input(){
12        cout << "Enter re "; cin >> re;
13        cout << "Enter img "; cin >> img;
14    }
15 };
16 void f1(complexCls c1){
17     c1.re=12;
18     c1.print();
19     c1.set(12,14);
20     c1.print();
21 }
22 int main(){
23     complexCls c1;
24     f1(c1);
25 }
```

```
3 struct complexCls{
4     double re = 0, img = 0; // Default
5     void set(double r = 0, double i = 0)
6     { re = r; img = i;}
7     void print(){
8         cout << '(' << re << ','
9             << img << ')' << endl;
10    }
11    void input(){
12        cout << "Enter re "; cin >> re;
13        cout << "Enter img "; cin >> img;
14    }
15 };
16 void f1(complexCls c1){
17     c1.re=12;
18     c1.print();
19     c1.set(12,14);
20     c1.print();
21 }
22 int main(){
23     complexCls c1;
24     f1(c1);
25 }
```

Attribute Default Value(II)

```
3 struct date{
4     int year, month, day;
5     void input(){
6         cout << "Year: ";
7         cin >> year;
8         cout << "Month: ";
9         cin >> month;
10        cout << "Day: ";
11        cin >> day;
12    }
13    void print(){
14        cout << year << '/' << month
15            << '/' << day << endl;
16    }
17 };
18 int main(){
19     date d1;
20     d1.input();
21     d1.print();
22     date d2;
23     d2.input();
24     d2.print();
25 }
```

```
3 struct date{
4     int year=1384, month=10, day=28;
5     void input(void){
6         cout << "Year: ";
7         cin >> year;
8         cout << "Month: ";
9         cin >> month;
10        cout << "Day: ";
11        cin >> day;
12    }
13    void print(void){
14        cout << year << '/' << month
15            << '/' << day << endl;
16    }
17 };
18 int main(){
19     date d1;
20     d1.input();
21     d1.print();
22     date d2;
23     d2.input();
24     d2.print();
25 }
```

Attribute Default Value(III)

```
2 #include <cmath>
3 using namespace std;
4 struct point{
5     double x, y;
6     void input(void) {
7         cout << "Enter X: ";
8         cin >> x;
9         cout << "Enter Y: ";
10        cin >> y;
11    }
12    void print(void) {
13        cout << '(' << x << ', '
14            << y << ')' << endl;
15    }
16    void move(double dx=1, double dy=0){
17        x += dx;
18        y += dy;
19    }
20    double magnitude(void){ // length
21        return sqrt(pow(x, 2)+pow(y, 2));
22    }
23 };
24 int main(){
25     point p1;
26     p1.print();
27     p1.input();
28     p1.print();
29     p1.move(3);
30     cout << p1.magnitude() << endl;
31 }
```

```
2 #include <cmath>
3 using namespace std;
4 struct point{
5     double x=0, y=0;
6     void input(void) {
7         cout << "Enter X: ";
8         cin >> x;
9         cout << "Enter Y: ";
10        cin >> y;
11    }
12    void print(void) {
13        cout << '(' << x << ', '
14            << y << ')' << endl;
15    }
16    void move(double dx=1, double dy=0){
17        x += dx;
18        y += dy;
19    }
20    double magnitude(void){ // length
21        return sqrt(pow(x, 2)+pow(y, 2));
22    }
23 };
24 int main(){
25     point p1;
26     p1.print();
27     p1.input();
28     p1.print();
29     p1.move(3);
30     cout << p1.magnitude() << endl;
31 }
```

MyArray Struct(I)

```
1 #include <iostream>
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n;
6     void set(double ma[], int k){
7         n = k;
8         for(int i = 0; i < n; i++)
9             a[i] = ma[i];
10    }
11    void print(void){
12        cout << " n = " << n << endl;
13        for(int i = 0; i < n; i++)
14            cout << "a[" << i << "] = "
15                << a[i] << endl;
16    }
17 };
18 int main(){
19     double x[] = {10, 12, 34, 54};
20     myArray d;
21     d.set(x, 4);
22     d.print();
23 }
```

```
1 #include <iostream>
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n;
6     void set(double ma[], int k){
7         n = k;
8         for(int i=0; i < n; i++)
9             a[i] = ma[i];
10    }
11    void print(void){
12        cout << " n = " << n << endl;
13        for(int i = 0; i < n; i++)
14            cout << "a[" << i << "] = "
15                << a[i] << endl;
16    }
17 };
18 int main(){
19     double x[] {10, 12, 34, 54};
20     myArray d;
21     d.set(x, 4);
22     d.print();
23 }
```

MyArray Struct(II)

```
1 #include <iostream>
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         n = k;
8         for(int i = 0; i < n; i++)
9             a[i] = ma[i];
10    }
11    void print(void){
12        cout << " n = " << n << endl;
13        for(int i = 0; i < n; i++)
14            cout << "a[" << i << "] = "
15                << a[i] << endl;
16    }
17 };
18 int main(){
19     double x[]={10, 12, 34, 54};
20     myArray d;
21     d.set(x, sizeof(x) / sizeof(double));
22     d.print();
23 }
```

```
1 #include <iostream> //MyArray/100422
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         n = k;
8         for(int i = 0; i < n; i++)
9             a[i] = ma[i];
10    }
11    void print(void){
12        cout << " n = " << n << endl;
13        for(int i = 0; i < n; i++)
14            cout << "a[" << i << "] = "
15                << a[i] << endl;
16    }
17 };
18 int main(){
19     double x[]={10, 12, 34, 54};
20     myArray d;
21     d.set(x, sizeof(x) / sizeof(x[0]));
22     d.print();
23 }
```


MyArray Struct(III) - Error

```
1 #include <iostream>
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         n = k;
8         for(int i = 0; i < n; i++){
9             a[i] = ma[i];
10        }
11        void print(void){
12            cout << " n = " << n << endl;
13            for(int i = 0; i < n; i++){
14                cout << "a[" << i << "] = "
15                    << a[i] << endl;
16            }
17        };
18    int main(){
19        double x[]={10, 12, 34, 54};
20        myArray d;
21        d.set(x, sizeof(x) / sizeof(double));
22        d.print();
23    }
```

```
1 #include <iostream> //MyArray/100423.22
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         if(k >= 0 && k <= 100){
8             n = k;
9             for(int i = 0; i < n; i++){
10                a[i] = ma[i];
11            }
12        }
13        else
14            cout << "Number of Elements is wrong"
15                << k << endl;
16    }
17    void print(void){
18        cout << " n = " << n << endl;
19        for(int i = 0; i < n; i++){
20            cout << "a[" << i << "] = "
21                << a[i] << endl;
22        }
23    };
24    int main(){
25        double x[]={10, 12, 34, 54};
26        myArray d;
27        d.set(x, sizeof(x) / sizeof(x[0]));
28        d.print();
29    }
```

- Check Array Bounds

Error in Action

```
1 #include <iostream>
2 using namespace std;
3 struct myArray{//100423.33.cpp
4     int n = 0;
5     double a[100];
6     void set(double ma[], int k){
7         n = k;
8         for(int i = 0; i < n; i++)
9             a[i] = ma[i];
10    }
11    void print(void){
12        cout << " n = " << n << endl;
13        for(int i = 0; i < n; i++)
14            cout << "a[" << i << "] = "
15                << a[i] << endl;
16    }
17 };
18 int main(){
19     double x[2000]{10, 12, 34, 54};
20     myArray d;
21     d.set(x, 2000);
22     d.print();
23     myArray ax[30000];
24     for(int i=0 ; i<30000; i++){
25         ax[i].set(x, 2000);
26         ax[i].print();
27     }
28 }
29
30 /* ./a.out
31 Segmentation fault (core dumped)
32 */
```

Order of properties and methods is irrelevant in struct

```
1 #include <iostream> //MyArray/100423.22
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         if(k >= 0 && k <= 100){
8             n = k;
9             for(int i = 0; i < n; i++)
10                 a[i] = ma[i];
11         }
12         else
13             cout << "Number of Elements is wrong"
14                 << k << endl;
15     }
16     void print(void){
17         cout << " n = " << n << endl;
18         for(int i = 0; i < n; i++)
19             cout << "a[" << i << "] = "
20                 << a[i] << endl;
21     }
22 };
23 int main(){
24     double x[] {10, 12, 34, 54};
25     myArray d;
26     d.set(x, sizeof(x) / sizeof(x[0]));
27     d.print();
28 }
```

```
1 #include <iostream> //MyArray/100423.44
2 using namespace std;
3 struct myArray{
4     void set(double ma[], int k){
5         if(k >= 0 && k < 100)
6             for(n = k--; k >= 0; k--)
7                 a[k] = ma[k];
8         else
9             cout << "Number of Elements is wrong"
10                 << k << endl;
11     }
12     void print(void){
13         cout << " n = " << n << endl;
14         for(int i = 0; i < n; i++)
15             cout << "a[" << i << "] = "
16                 << a[i] << endl;
17     }
18
19     double a[100];
20     int n = 0;
21 };
22 int main(){
23     double x[] {10, 12, 34, 54};
24     myArray d;
25     d.set(x, sizeof(x) / sizeof(x[0]));
26     d.print();
27 }
```

MyArray Struct(IV) Const(I)

```
1 #include <iostream> //MyArray/100423.22
2 using namespace std;
3 struct myArray{
4     double a[100];
5     int n = 0;
6     void set(double ma[], int k){
7         if(k >= 0 && k <= 100){
8             n = k;
9             for(int i = 0; i < n; i++){
10                 a[i] = ma[i];
11             }
12         }
13         else
14             cout << "Number of Elements is wrong"
15                 << k << endl;
16     }
17     void print(void){
18         cout << " n = " << n << endl;
19         for(int i = 0; i < n; i++)
20             cout << "a[" << i << "] = "
21                 << a[i] << endl;
22     }
23 };
24 int main(){
25     double x[]{10, 12, 34, 54};
26     myArray d;
27     d.set(x, sizeof(x) / sizeof(x[0]));
28     d.print();
29 }
```

```
1 #include <iostream> //MyArray/100424
2 using namespace std;
3 const int MAX_NUMBER_OF_CELLS = 100;
4 struct myArray{
5     double a[MAX_NUMBER_OF_CELLS];
6     int n = 0;
7     void set(double ma[], int k){
8         if(k >= 0 && k < MAX_NUMBER_OF_CELLS){
9             n = k;
10            for(int i = 0; i < n; i++){
11                a[i] = ma[i];
12            }
13        }
14        else
15            cout << "Number of Elements is wrong"
16                << k << endl;
17    }
18    void print(void){
19        cout << " n = " << n << endl;
20        for(int i = 0; i < n; i++)
21            cout << "a[" << i << "] = "
22                << a[i] << endl;
23    }
24 };
25 int main(){
26     double x[]{10, 12, 34, 54};
27     myArray d;
28     d.set(x, sizeof(x) / sizeof(x[0]));
29     d.print();
30 }
```

MyArray Struct(V) Const(II)

```
1 #include <iostream> //MyArray/100424
2 using namespace std;
3 const int MAX_NUMBER_OF_CELLS = 100;
4 struct myArray{
5     double a[MAX_NUMBER_OF_CELLS];
6     int n = 0;
7     void set(double ma[], int k){
8         if(k >= 0 && k < MAX_NUMBER_OF_CELLS){
9             n = k;
10            for(int i = 0; i < n; i++){
11                a[i] = ma[i];
12            }
13        }
14        else
15            cout << "Number of Elements is wrong"
16            << k << endl;
17    }
18    void print(void){
19        cout << " n = " << n << endl;
20        for(int i = 0; i < n; i++){
21            cout << "a[" << i << "] = "
22            << a[i] << endl;
23        }
24    };
25    int main(){
26        double x[] {10, 12, 34, 54};
27        myArray d;
28        d.set(x, sizeof(x) / sizeof(x[0]));
29        d.print();
30    }
```

```
1 #include <iostream> //MyArray/100426.22
2 using namespace std;
3 const int MAX_NUMBER_OF_CELLS = 100;
4 struct myArray{
5     double a[MAX_NUMBER_OF_CELLS];
6     int n = 0;
7     void set(const double ma[], const int k){
8         if(k >= 0 && k < MAX_NUMBER_OF_CELLS){
9             n = k;
10            for(int i = 0; i < n; i++){
11                a[i] = ma[i];
12            }
13        }
14        else
15            cout << "Number of Elements is wrong"
16            << k << endl;
17    }
18    void print(void){
19        cout << " n = " << n << endl;
20        for(int i = 0; i < n; i++){
21            cout << "a[" << i << "] = "
22            << a[i] << endl;
23        }
24    };
25    int main(){
26        double x[] {10, 12, 34, 54};
27        myArray d;
28        d.set(x, sizeof(x) / sizeof(x[0]));
29        d.print();
30    }
```

END

