C++

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موسسه ی پارس پژوهان

فصل دوم

- **Variables**
- **data types**
- **Identifiers**
- **Constants**

Variables

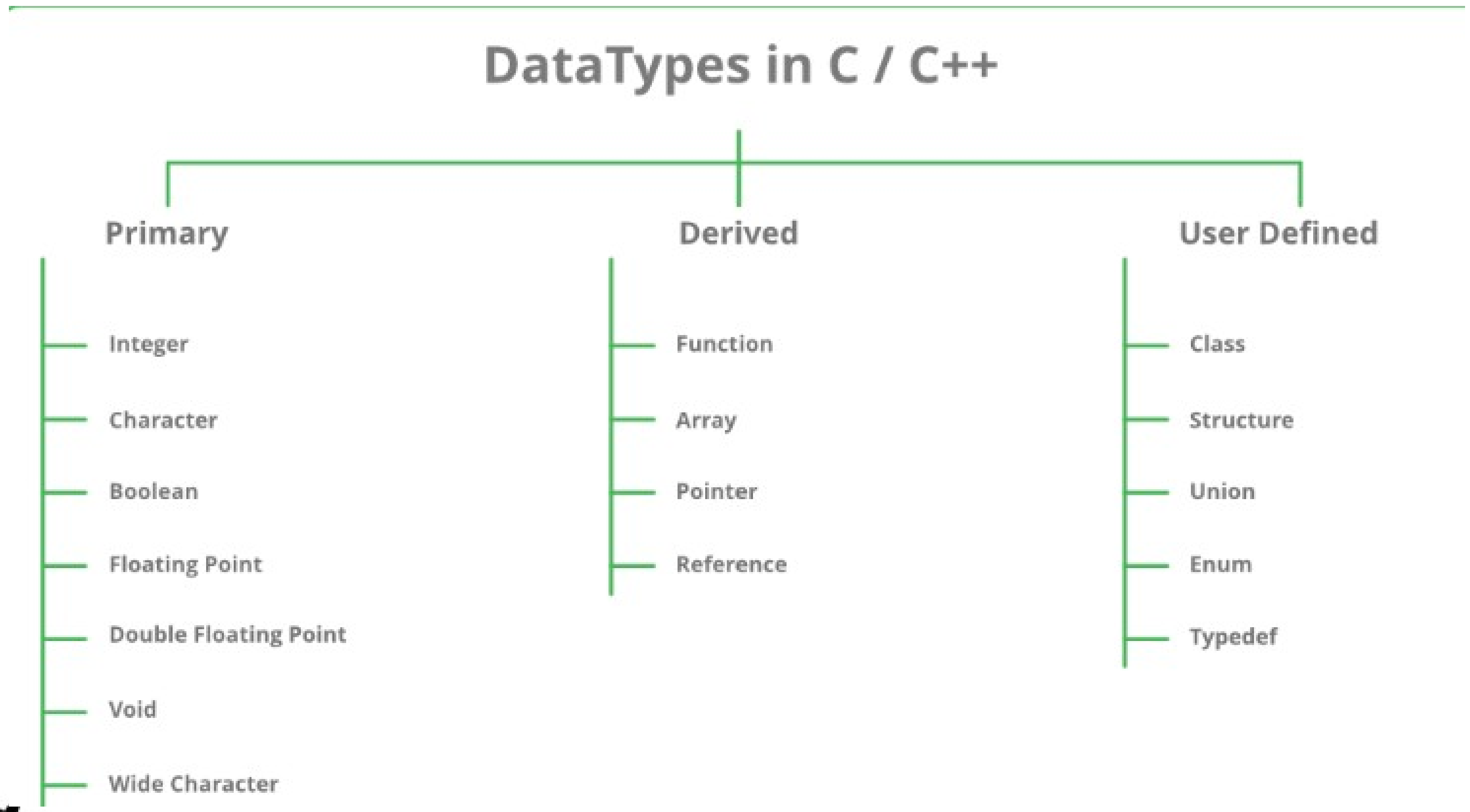
- Creating a variable reserves a memory location, or a space in memory for storing values. The compiler requires that you provide a data type for each variable you declare.

data types

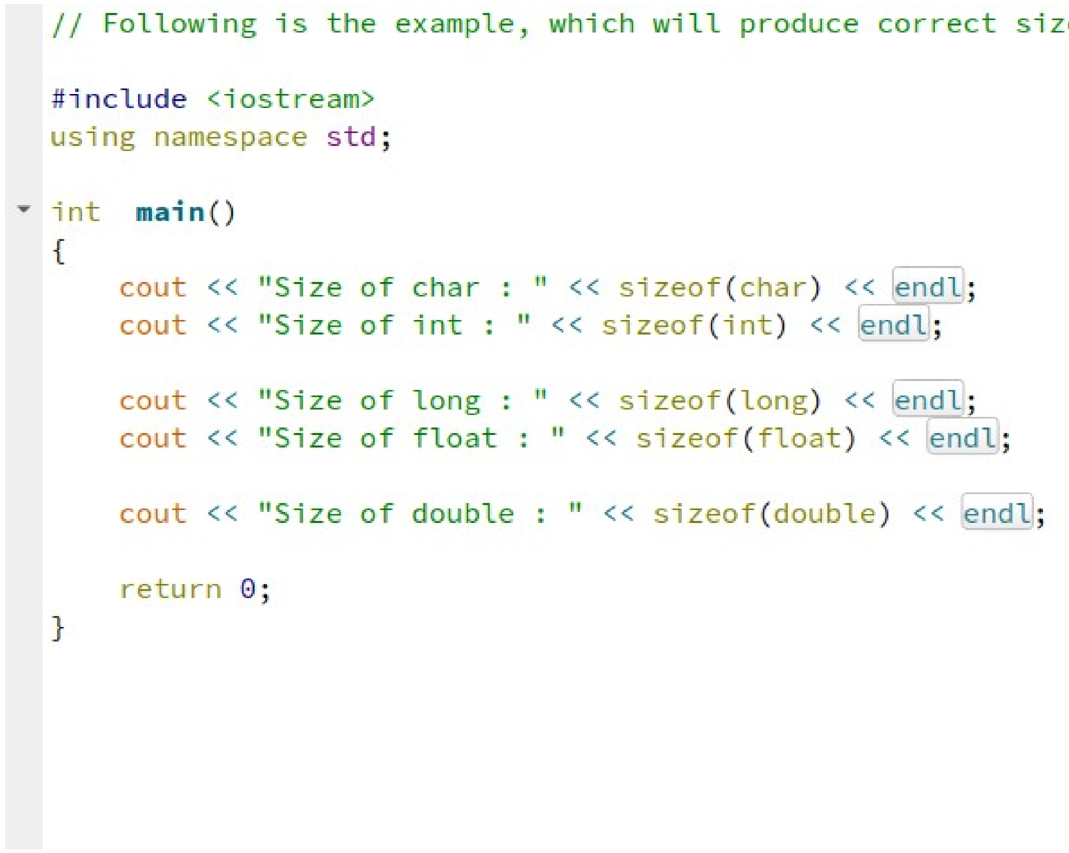
Data Type	Size	Description
`boolean`	1 byte	Stores true or false values
`char`	1 byte	Stores a single character/letter/number, or ASCII values
`int`	2 or 4 bytes	Stores whole numbers, without decimals
`float`	4 bytes	Stores fractional numbers, containing one or more decimals. Sufficient for storing 7 decimal digits
`double`	8 bytes	Stores fractional numbers, containing one or more decimals. Sufficient for storing 15 decimal digits

```
int myNum = 9;
double myDoubleNum = 8.99;
char myLetter = 'A';
bool myBool = false;
string myText = "Hello World";
```

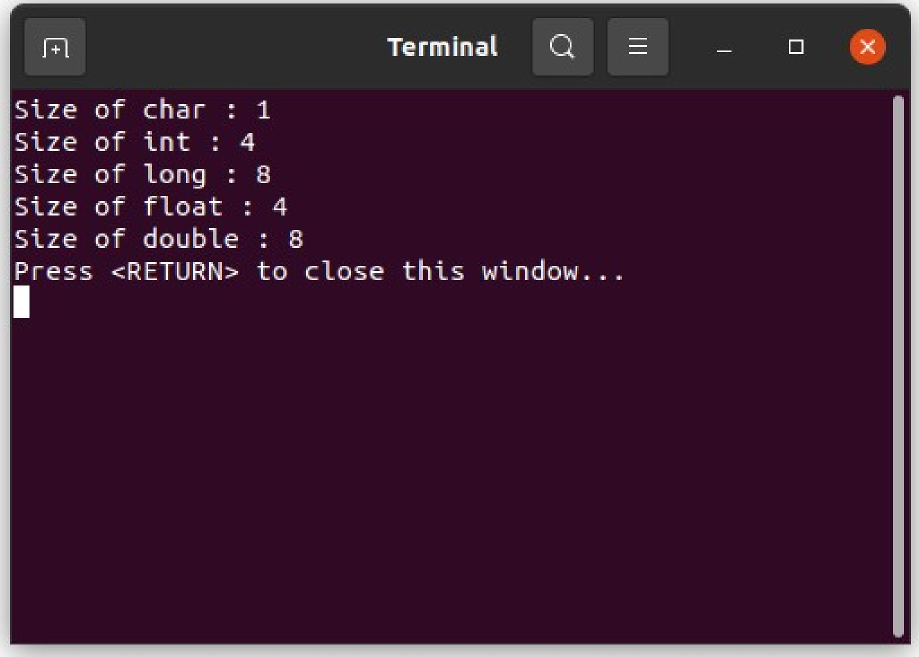
data types


DataTypes in C / C++
Primary
Integer
Character
Boolean
Floating Point
Double Floating Point
Void
Wide Character
Derived
Function
Array
Pointer
Reference
User Defined
Class
Structure
Union
Enum
Typedef

sizeof()



```cpp
// Following is the example, which will produce correct size of various data types on your computer.

#include <iostream>
using namespace std;

int  main()
{
    cout << "Size of char : " << sizeof(char) << endl;
    cout << "Size of int : " << sizeof(int) << endl;

    cout << "Size of long : " << sizeof(long) << endl;
    cout << "Size of float : " << sizeof(float) << endl;

    cout << "Size of double : " << sizeof(double) << endl;

    return 0;
}
```



```
Size of char : 1
Size of int : 4
Size of long : 8
Size of float : 4
Size of double : 8
Press <RETURN> to close this window...
```

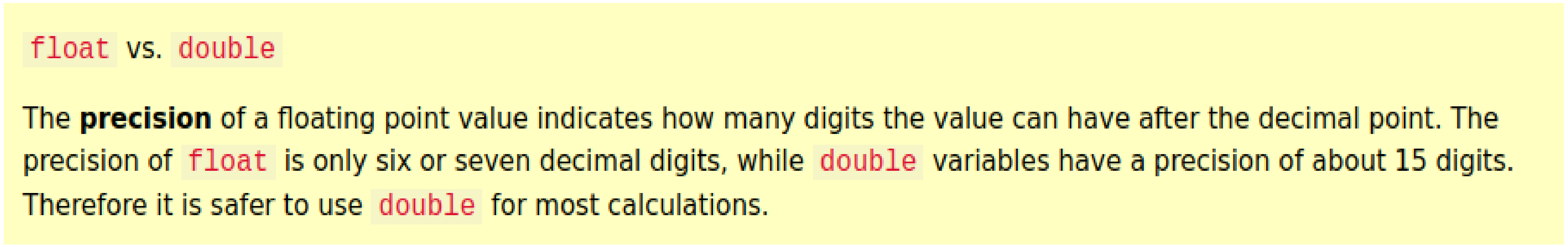
Variables

- Define all variables with a name and a data type before using them in a program. In cases in which you have multiple variables of the same type, it's possible to define them in one declaration, separating them with commas

```
int a, b;
// defines two variables of type int
```

Numeric Types

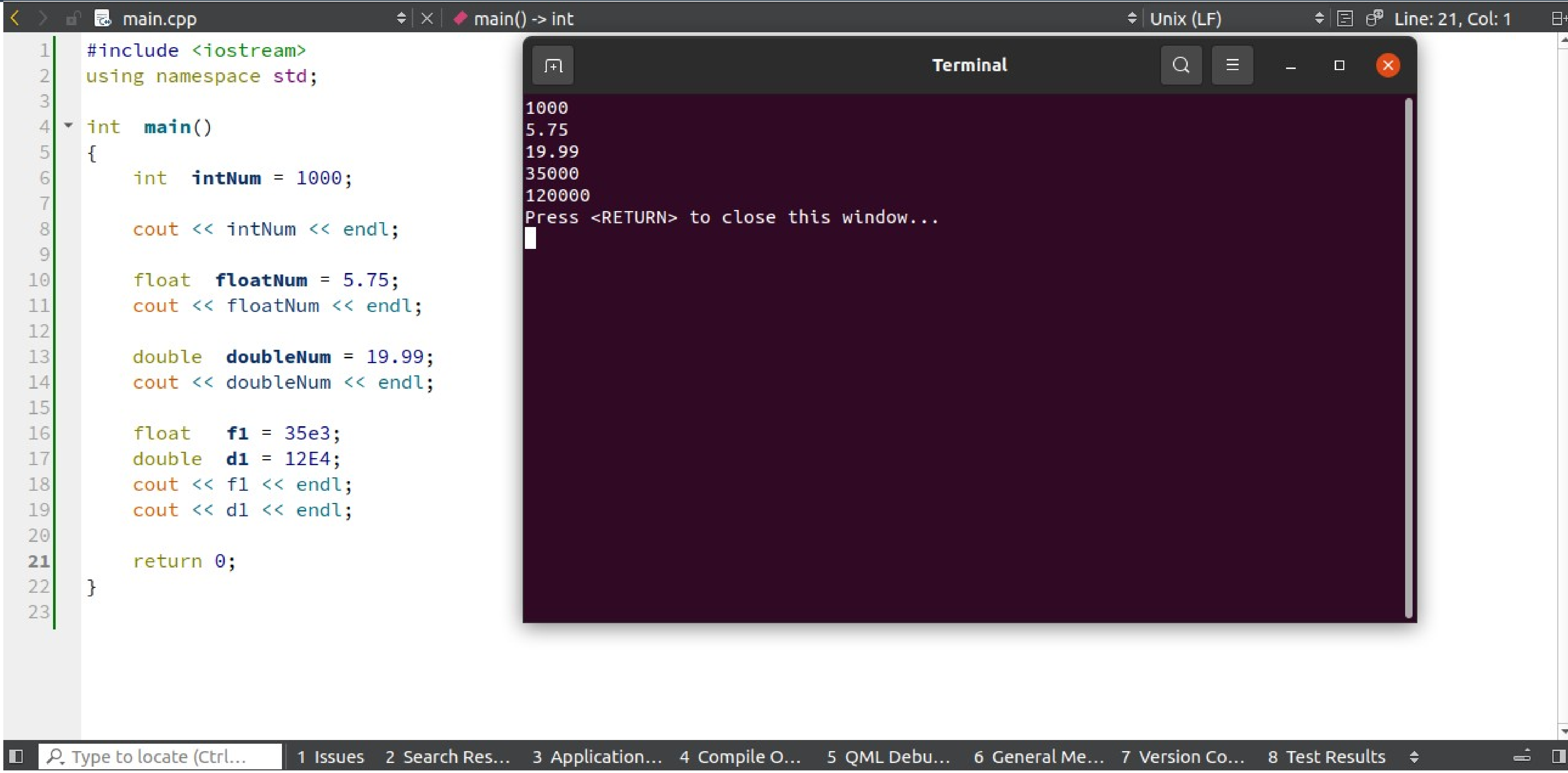
use int (Integer) when you need to store a whole number without decimals, like 35 or 1000, and float or double when you need a floating point number (with decimals), like 9.99 or 3.14515.



`float` vs. `double`

The **precision** of a floating point value indicates how many digits the value can have after the decimal point. The precision of `float` is only six or seven decimal digits, while `double` variables have a precision of about 15 digits. Therefore it is safer to use `double` for most calculations.

Example



```cpp
#include <iostream>
using namespace std;

int  main()
{
    int  intNum = 1000;

    cout << intNum << endl;

    float  floatNum = 5.75;
    cout << floatNum << endl;

    double  doubleNum = 19.99;
    cout << doubleNum << endl;

    float   f1 = 35e3;
    double  d1 = 12E4;
    cout << f1 << endl;
    cout << d1 << endl;

    return 0;
}
```

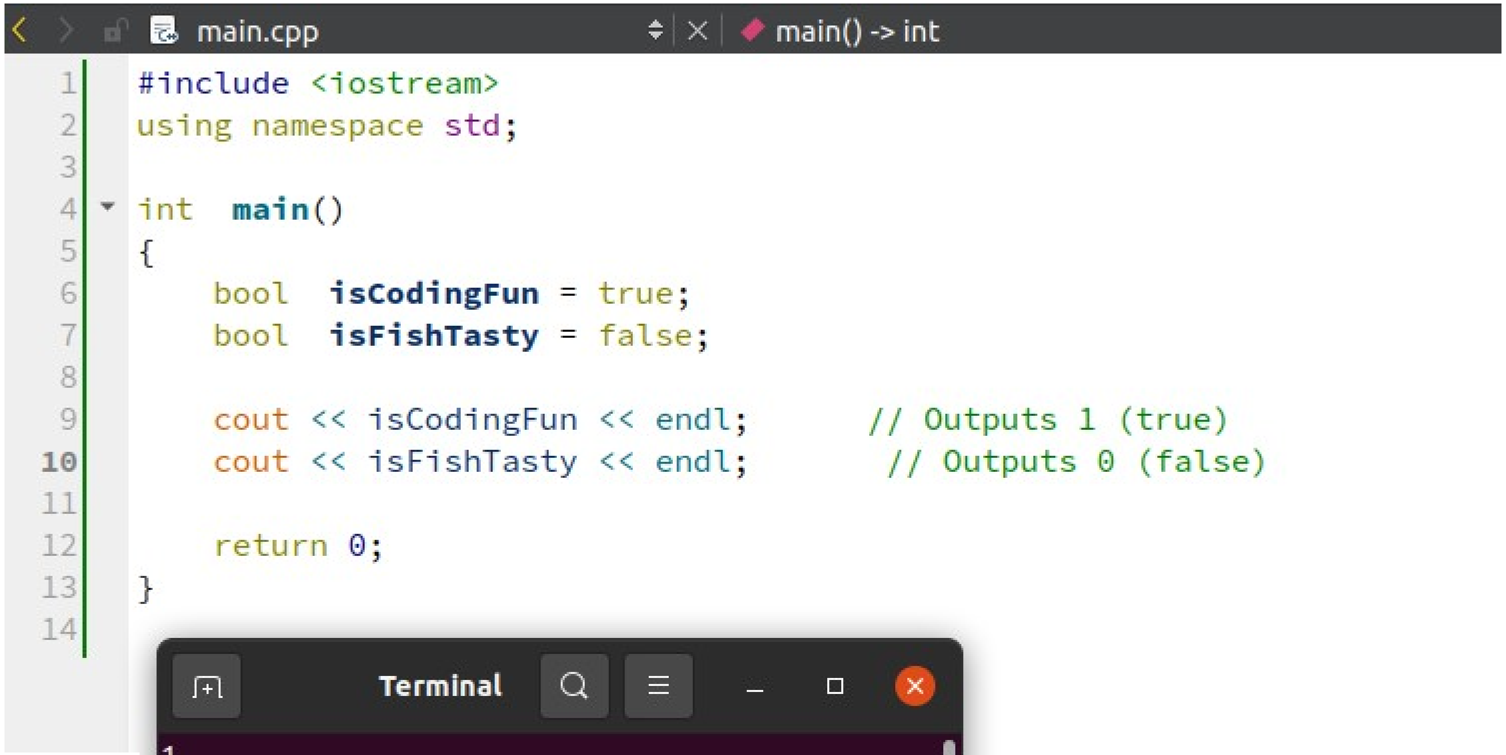
```
1000
5.75
19.99
35000
120000
Press <RETURN> to close this window...
```

Boolean Types

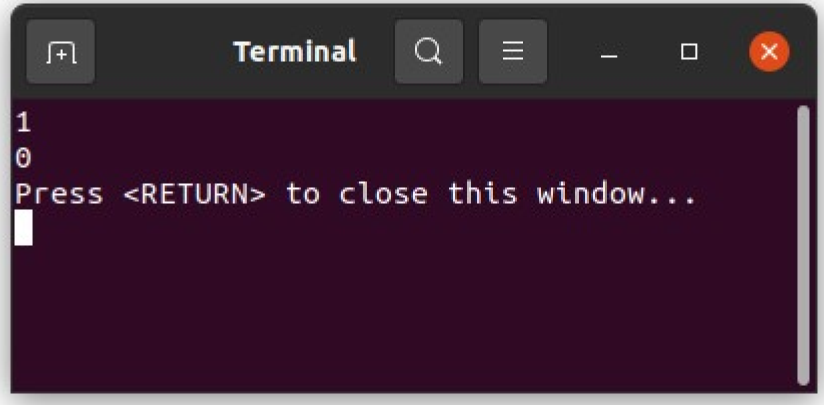
- A **Boolean** data type is declared with the **bool** keyword and can only take the values **true** or **false**.
- When the value is returned, **true = 1** and **false = 0**.

Boolean values are mostly used for conditional testing, which you will learn more about in a later chapter.

Example



```cpp
#include <iostream>
using namespace std;

int  main()
{
    bool  isCodingFun = true;
    bool  isFishTasty = false;

    cout << isCodingFun << endl;      // Outputs 1 (true)
    cout << isFishTasty << endl;       // Outputs 0 (false)

    return 0;
}
```

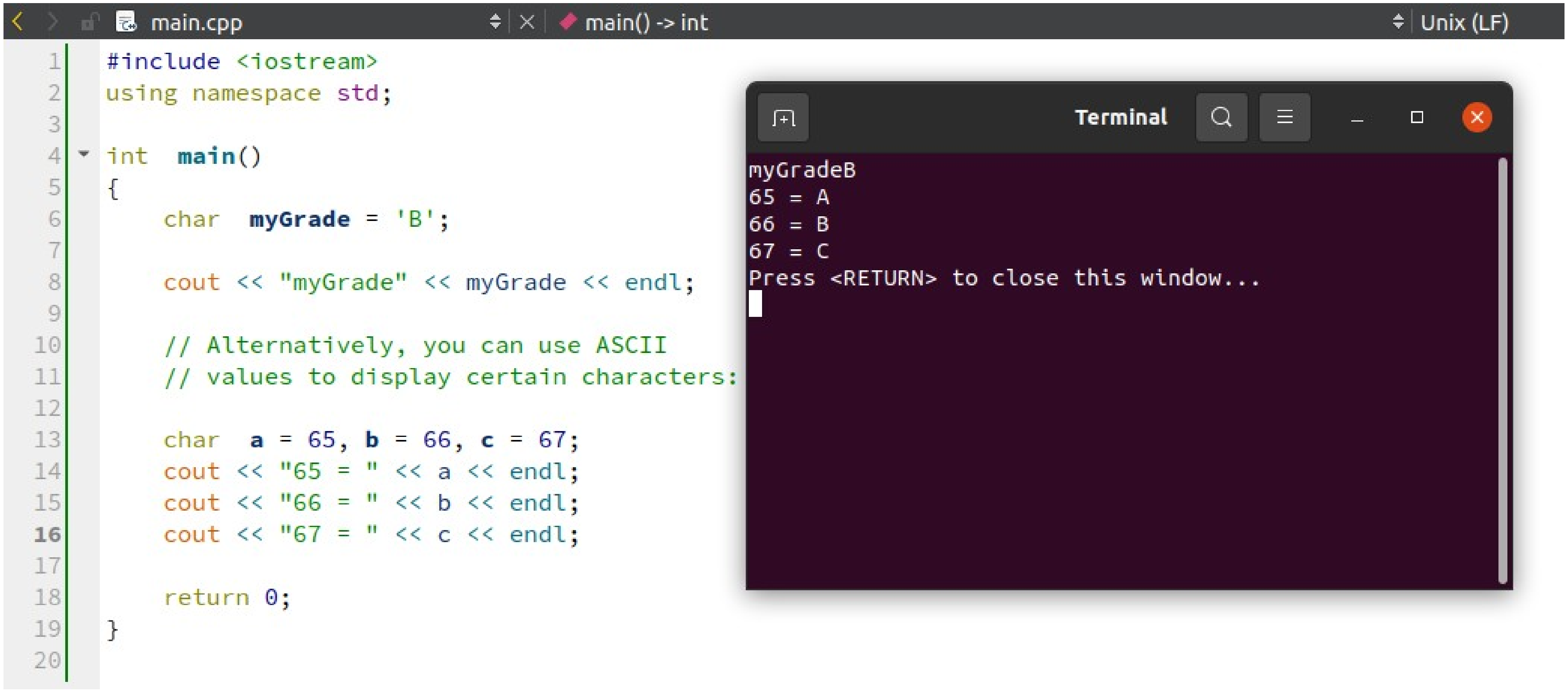


```
1
0
Press <RETURN> to close this window...
```

Character Types

- The **char** data type is used to store a single **character**. The character must be surrounded by single quotes, like **'A'** or **'c'**

Example



```cpp
#include <iostream>
using namespace std;

int  main()
{
    char  myGrade = 'B';

    cout << "myGrade" << myGrade << endl;

    // Alternatively, you can use ASCII
    // values to display certain characters:

    char  a = 65, b = 66, c = 67;
    cout << "65 = " << a << endl;
    cout << "66 = " << b << endl;
    cout << "67 = " << c << endl;

    return 0;
}
```

```
myGradeB
65 = A
66 = B
67 = C
Press <RETURN> to close this window...
```

ASCII

- The American Standard Code for Information Interchange (ASCII) is a means of encoding characters for digital communications. It was originally developed in the early 1960s as early networked communications were being developed.

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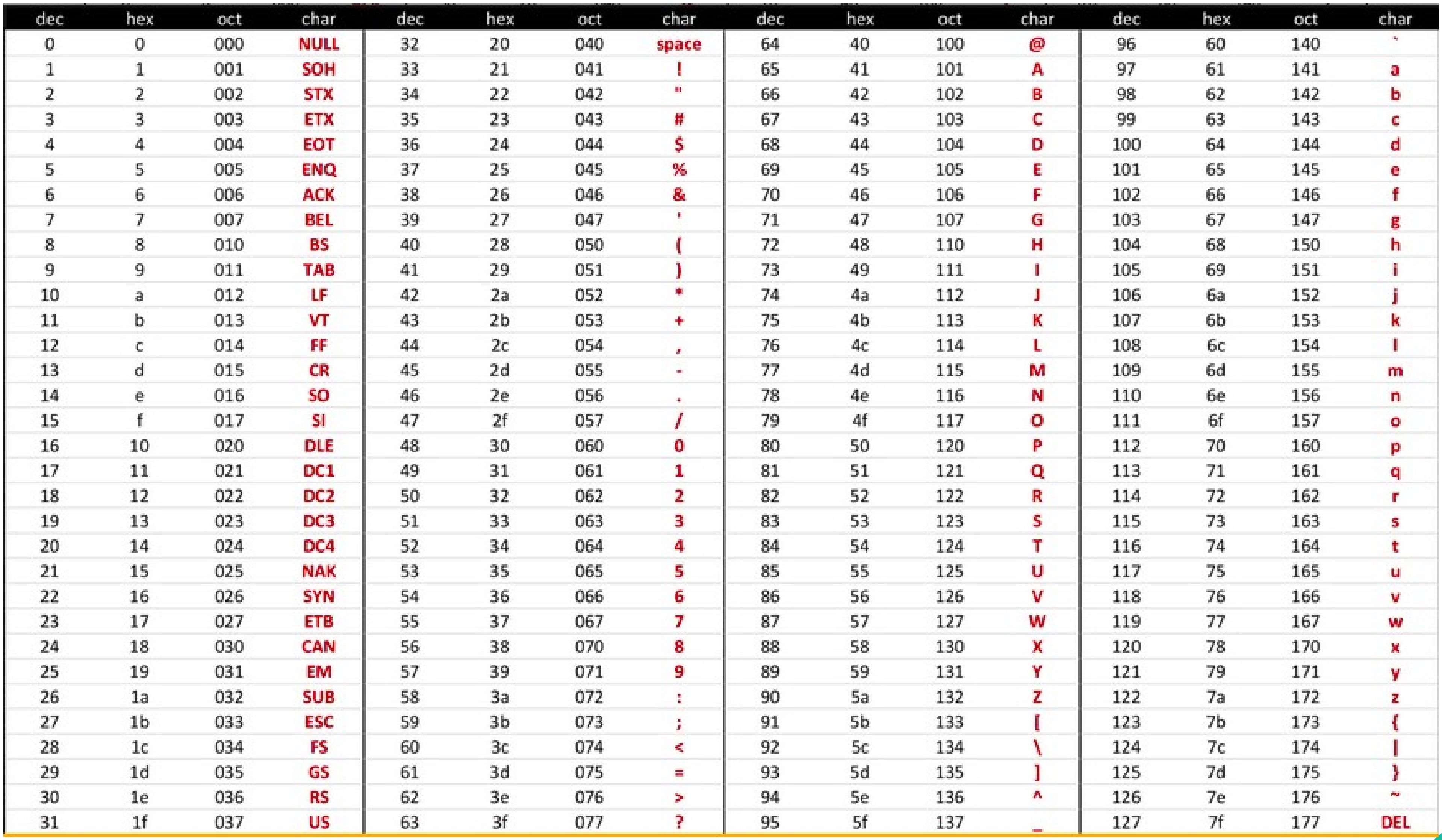
ASCII



dec	hex	oct	char	dec	hex	oct	char	dec	hex	oct	char	dec	hex	oct	char
0	0	000	NULL	32	20	040	space	64	40	100	@	96	60	140	`
1	1	001	SOH	33	21	041	!	65	41	101	A	97	61	141	a
2	2	002	STX	34	22	042	"	66	42	102	B	98	62	142	b
3	3	003	ETX	35	23	043	#	67	43	103	C	99	63	143	c
4	4	004	EOT	36	24	044	$	68	44	104	D	100	64	144	d
5	5	005	ENQ	37	25	045	%	69	45	105	E	101	65	145	e
6	6	006	ACK	38	26	046	&	70	46	106	F	102	66	146	f
7	7	007	BEL	39	27	047	'	71	47	107	G	103	67	147	g
8	8	010	BS	40	28	050	(	72	48	110	H	104	68	150	h
9	9	011	TAB	41	29	051	)	73	49	111	I	105	69	151	i
10	a	012	LF	42	2a	052	*	74	4a	112	J	106	6a	152	j
11	b	013	VT	43	2b	053	+	75	4b	113	K	107	6b	153	k
12	c	014	FF	44	2c	054	,	76	4c	114	L	108	6c	154	l
13	d	015	CR	45	2d	055	-	77	4d	115	M	109	6d	155	m
14	e	016	SO	46	2e	056	.	78	4e	116	N	110	6e	156	n
15	f	017	SI	47	2f	057	/	79	4f	117	O	111	6f	157	o
16	10	020	DLE	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM	57	39	071	9	89	59	131	Y	121	79	171	y
26	1a	032	SUB	58	3a	072	:	90	5a	132	Z	122	7a	172	z
27	1b	033	ESC	59	3b	073	;	91	5b	133	[	123	7b	173	{
28	1c	034	FS	60	3c	074	<	92	5c	134	\	124	7c	174	|
29	1d	035	GS	61	3d	075	=	93	5d	135	]	125	7d	175	}
30	1e	036	RS	62	3e	076	>	94	5e	136	^	126	7e	176	~
31	1f	037	US	63	3f	077	?	95	5f	137	_	127	7f	177	DEL

String Types

- The string type is used to store a sequence of characters (text). This is not a built-in type, but it behaves like one in its most basic usage. String values must be surrounded by double quotes:

```
string greeting = "Hello";
cout << greeting;
```

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Identifiers

- Identifiers == شناسه

- All C++ variables must be identified with unique names.
- These unique names are called identifiers.
- Identifiers can be short names (like x and y) or more descriptive names (age, sum, totalVolume).

Note: It is recommended to use descriptive names in order to create understandable and maintainable code.

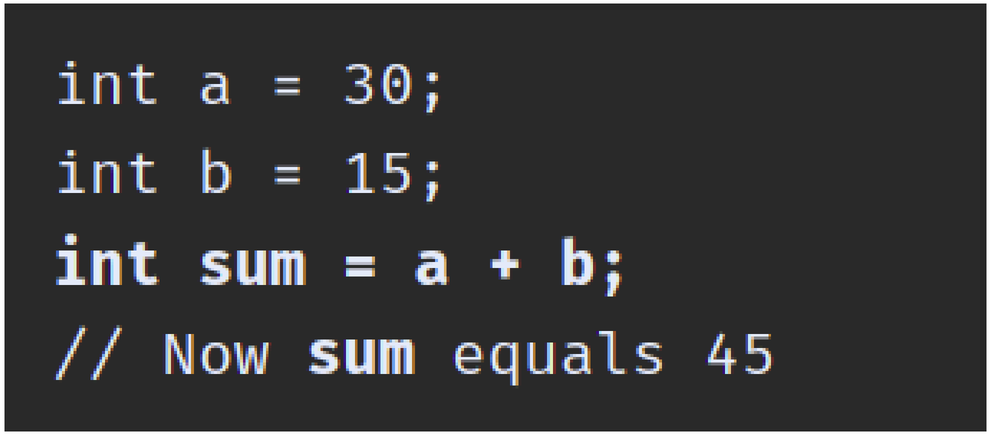
Identifiers

The general rules for naming variables are:

- Names can contain letters, digits and underscores
- Names must begin with a letter or an underscore (_)
- Names are case sensitive (`myVar` and `myvar` are different variables)
- Names cannot contain whitespaces or special characters like !, #, %, etc.
- Reserved words (like C++ keywords, such as `int`) cannot be used as names

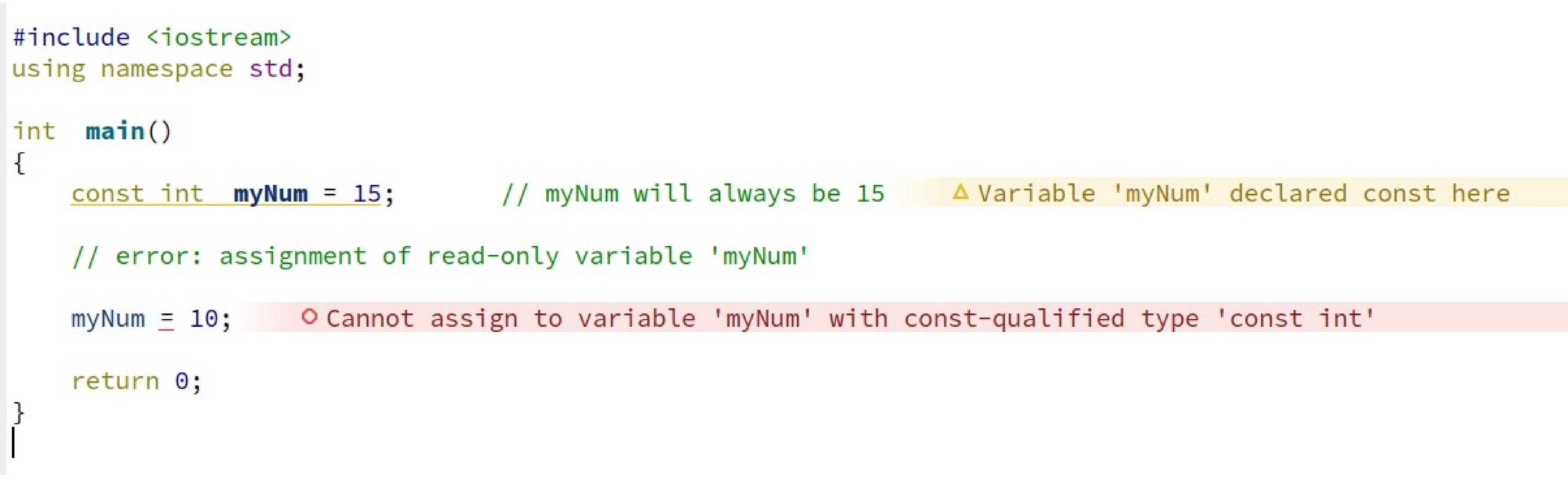
Variables

- A variable can be assigned a value, and can be used to perform operations.
- For example, we can create an additional variable called sum, and add two variables together.



```
int a = 30;
int b = 15;
int sum = a + b;
// Now sum equals 45
```

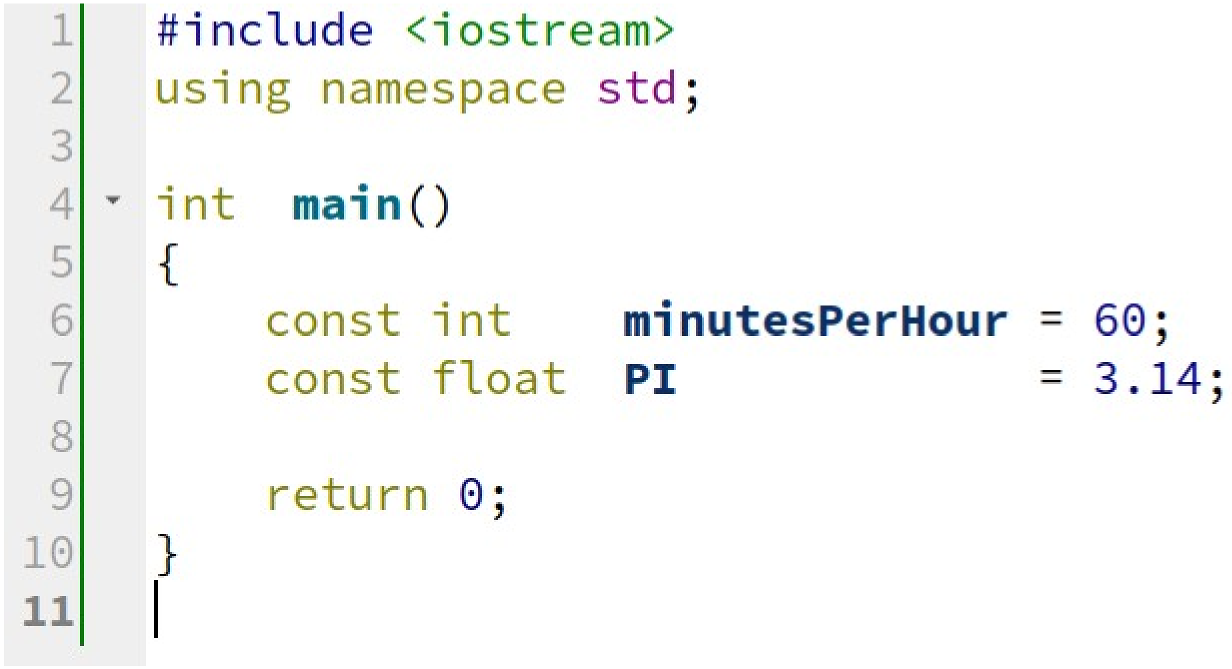
Constants



```
#include <iostream>
using namespace std;

int  main()
{
    const int  myNum = 15;       // myNum will always be 15     ⚠ Variable 'myNum' declared const here

    // error: assignment of read-only variable 'myNum'

    myNum = 10;     ○ Cannot assign to variable 'myNum' with const-qualified type 'const int'

    return 0;
}
```

When you do not want others (or yourself) to **override** existing variable values, use the **const** keyword (this will declare the variable as "constant", which **means unchangeable and read-only**)

Constants



```
#include <iostream>
using namespace std;

int  main()
{
    const int    minutesPerHour = 60;
    const float  PI             = 3.14;

    return 0;
}

```

تمرین

David and Alex each have aquariums. There are 8 Rainbowfishes in David’s aquarium, and 11 Angelfishes in Alex’s aquarium. Help them exchange their fishes between them.

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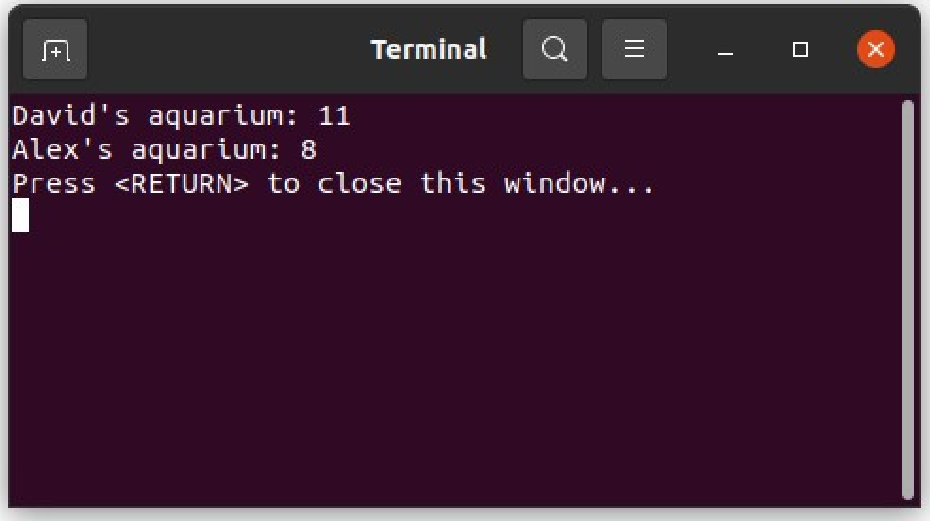
پاسخ

```
 #include <iostream>
using namespace std;

int  main()
{
    int  aquariumDavid = 8;
    int  aquariumAlex  = 11;

// your code goes here
    int  s = aquariumDavid;

    aquariumDavid = aquariumAlex;

    aquariumAlex = s;

    cout << "David's aquarium: " << aquariumDavid << endl;
    cout << "Alex's aquarium: " << aquariumAlex << endl;

    return 0;
}
```



```
David's aquarium: 11
Alex's aquarium: 8
Press <RETURN> to close this window...
```

Question ?