A+ Computer Science

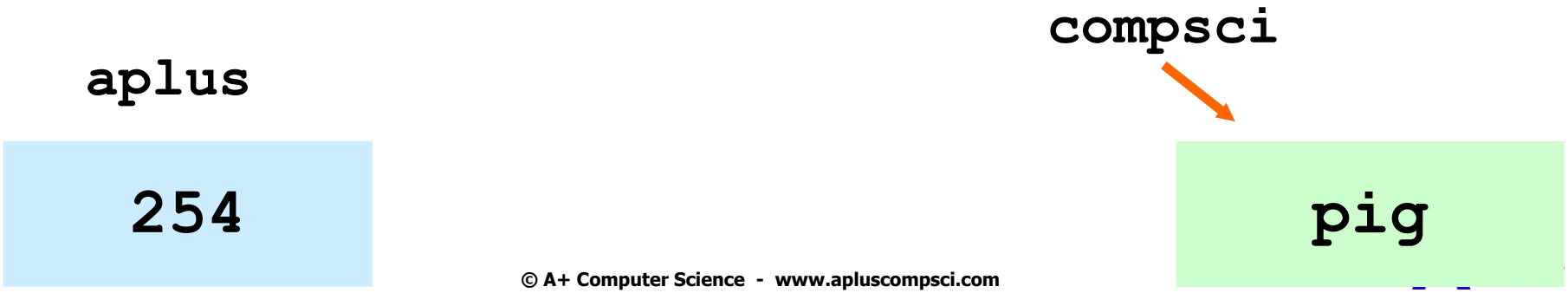
VARIABLES

Variables

What is a variable?

A variable is a storage location for a specified type of value.

```
int aplus = 254;
String compsci = "pig";
boolean fun = true;
```



Naming Variables

What is an identifier?

An identifier is used to identify something.

```
public class Aplus{    }

int width = 7;
```

Always start identifier names with letters.

What is an identifier?

Which of these would be legal identifiers?

AplusCompSciRocks!
jump Up
2Foot5Inches
BigTriangle
SpaceInvaders

What is an identifier?

Always use names that mean something.

```
double  totalPay;
class Triangle{ }
```

```
double a;          //very bad
class B{}          //very bad
```

What is an identifier?

SAM does not equal sam.
Sam does not equal sam.
Same does not equal sam.

Case is important as is spelling.

What is a keyword?

Keywords are reserved words that the language uses for a specific purpose.

int double return void
static long break continue

Keywords cannot be used as identifiers.

identifiers.java

Types of Variables

Primitives

What is a primitive?

A primitive variable stores a value of the type specified.

```
double fun = 99.0;
```

What is a primitive?

```
int aplus = 254;
```

aplus

aplus stores an integer value.

int can only store whole numbers.

Primitive Types

int double boolean

int whole
double fraction

The type states how much and what kind of data the variable can store.

Primitive Types

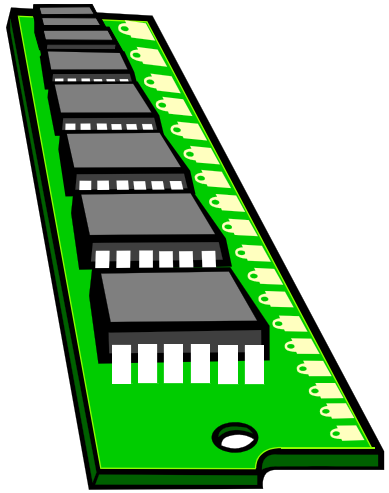
data type	memory usage	min .. max
byte	8 bits	-128 to 127
short	16 bits	-32768 to 32767
int	32 bits	-2 billion to 2 billion
long	64 bits	-big to +big
float	32 bits	-big to +big
double	64 bits	-big to +big
char	16 bit unsigned	0 - 65535
boolean	1 bit	true or false

It is important to know all data types and what each one can store.

Memory

Memory consists of bits and bytes.

8 bits = 1001 0010 = 1 byte



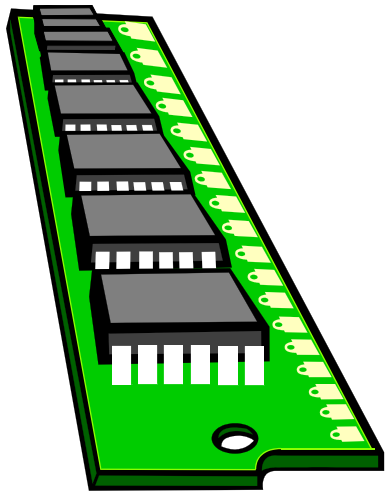
lolololooloooooIII
loooolooooIIIIIool
lolololololololIool

Memory

Memory consists of bits and bytes.

16 bits = 0101 1001 0100 1001 = 2 bytes

The more bits you have the more you can store.



1 byte = 8 bits

Integers

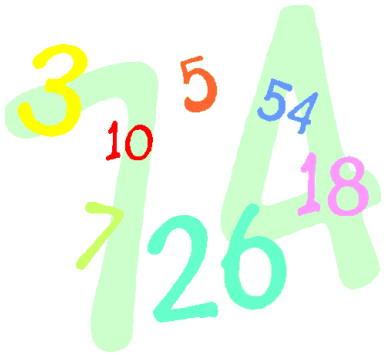
What is an integer?

```
int one = 120;
int two = 987123;
byte bite = 99;
long longInt = 99234423;

System.out.println(one);
System.out.println(two);
System.out.println(bite);
System.out.println(longInt);
```

OUTPUT

```
120
987123
99
99234423
```



What is an integer?

```
int one = 120.0;

System.out.println(one);
```

OUTPUT

LOP error

Integer types can store integer values only. Integer types cannot store fractional / decimal values.

Attempting to assign fractional / decimal values to an integer type results in a loss of precision compile error.

integers.java
integerslop.java

Real Numbers

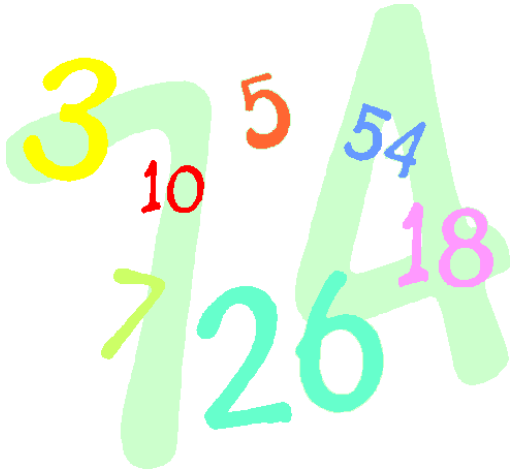
What is a real number?

```
double one = 99.57;
double two = 3217;
float three = 23.32f;

System.out.println(one);
System.out.println(two);
System.out.println(three);
```

OUTPUT

```
99.57
3217.0
23.32
```



What is a real number?

```
double one = 120.7;
System.out.println(one);
one = 125;
System.out.println(one);
```

OUTPUT

120.7
125.0

Real types can store fractional/decimal values as well as integer values.

reals.java

Booleans

What is a boolean?

```
boolean go = true;
System.out.println(go);
boolean stop = false;
System.out.println(stop);
```

OUTPUT

true
false

A boolean type can store true or false only.

booleans.java

Characters

What is a character?

```
char let = 'A';
char fun = 65;

char test = 'a';
char go = 97;

char what = 48;
```

char variables are used to store a single letter.

char variables are actually integers.

What is a character?

char is a 16-bit unsigned int data type.

Here is a 16 bit pattern: 0000000000110011

```
char let = 65;
let = 'A';          //same as let = 65
```

ASCII VALUES YOU MUST KNOW!

'A' – 65

'a' – 97

'0' - 48

Abstraction

Abstraction is a big part of Computer Science.

Complex details are hidden away / abstracted away to make the process of writing code easier.

Characters in Java code appear as letters but are really stored and manipulated as ASCII values which are converted to binary values.

Abstraction

A is 65 B is 66 C is 67 D is 68 and so on

'A' is really 0000000001000001

The word CAT would be converted to ASCII in the code. Then, the ASCII is converted to binary for storing and processing.

Letter	C	A	B
ASCII	67	65	66
Binary	01000011	01000001	01000010

What is a character?

'A' - 65	'B' - 66	'C' - 67	...
'a' - 97	'b' - 98	'c' - 99	...
'0' - 48	'1' - 49	'2' - 50	...

What is a character?

```
char alpha = 'A';
char ascii = 65;
char sum = 'B' + 1;

System.out.println(alpha);
System.out.println(ascii);
System.out.println(sum);
System.out.println('B'+1);
```

OUTPUT

```
A
A
C
67
```

chars.java

Work on Programs!

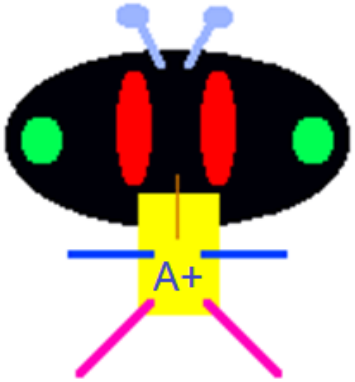
Crank Some Code!

References

What is a reference?

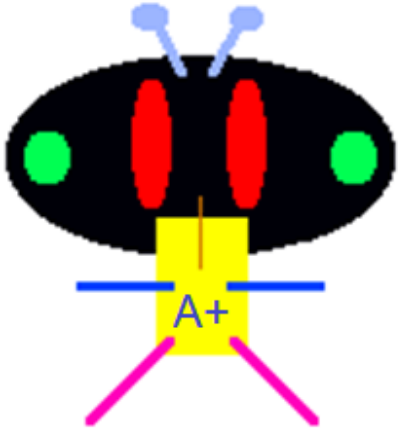
A reference variable stores the memory address of an object.

```
AplusBug cs = new AplusBug();
AplusBug dude = new AplusBug();
```



What is a reference?

AplusBug cs = new AplusBug();



cs

0xF5

0xF5

AplusBug Object

cs stores the address of an AplusBug.

Strings

What is a String?

```
String aplus = "hello world";
String buddy = "whoot - \\\\\\\\\\\\";

System.out.println( aplus );
System.out.println("buddy = " + buddy);
```

OUTPUT

hello world
buddy = whoot - \\\\\\

A String type stores groups of characters.

strings.java

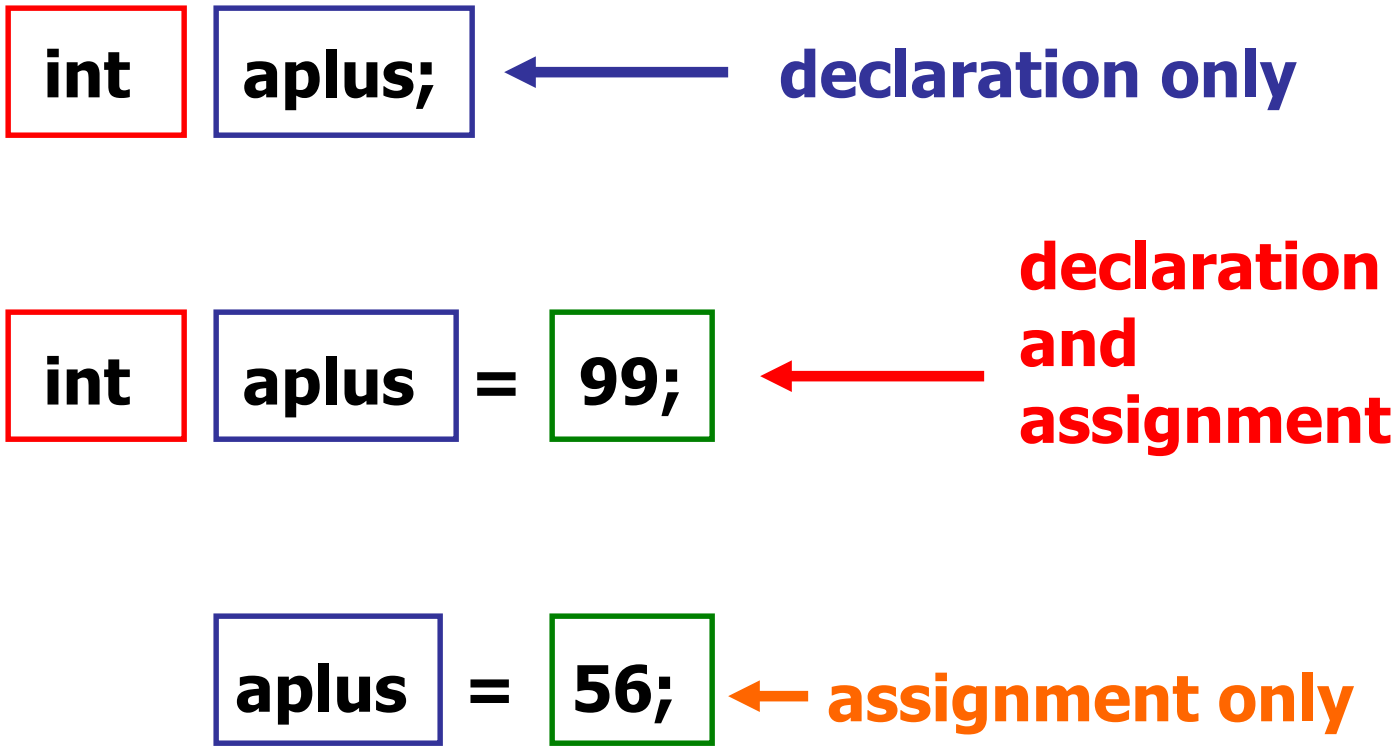
Assigning Variables

Assignment Statement

```
aplus  =  57;
aplus  =  239423;
```

In an assignment statement, the receiver is always on the left of the assignment operator (=).

Declaring vs. Assigning



Assignment Statement

```
int aplus = 52, compsci = 79;
double decy = 5.25;
char bigA = 'A', littleA = 'a';
boolean check = false;
String plus = "abc";

System.out.println( aplus );
System.out.println( compsci );
System.out.printf("%.2f", decy );
System.out.println( bigA );
System.out.println( littleA );
System.out.println( check );
System.out.println( plus );
```

OUTPUT

52
79
5.25A
a
false
abc

assignment.java

Final

Final?

```
final int x = 999;
System.out.println( x );
```

OUTPUT

999

A final variable can be assigned a value once. Designate a variable final if you do not want it to change after it has been declared and initialized.

MAX and Min

Max and min integers

```
System.out.println(Byte.MIN_VALUE);
System.out.println(Byte.MAX_VALUE);

System.out.println(Short.MIN_VALUE);
System.out.println(Short.MAX_VALUE);
```

MIN_VALUE and MAX_VALUE are very useful for contest programming.

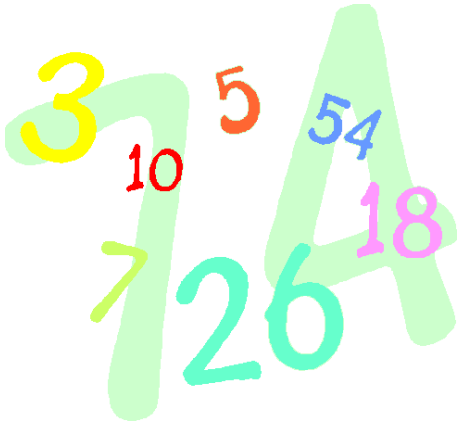
OUTPUT

-128
127
-32768
32767

Max and min integers

```
System.out.println(Integer.MIN_VALUE);
System.out.println(Integer.MAX_VALUE);

System.out.println(Long.MIN_VALUE);
System.out.println(Long.MAX_VALUE);
```



OUTPUT

```
-2147483648
2147483647
-9223372036854775808
9223372036854775807
```

Max and min integers

```
int num = Integer.MAX_VALUE;
num=num+1;
System.out.println(num);
num=num-1;
System.out.println(num);
```

Why does adding 1 to MAX_VALUE give you the MIN_VALUE?

OUTPUT

-2147483648
2147483647

integersminmax.java

Max and min reals

```
System.out.println(Float.MIN_VALUE);
System.out.println(Float.MAX_VALUE);

System.out.println(Double.MIN_VALUE);
System.out.println(Double.MAX_VALUE);
```

MIN_VALUE and MAX_VALUE are very useful for contest programming.

OUTPUT

```
1.4E-45
3.4028235E38
4.9E-324
1.79769313486231570E308
```

realsminmax.java

Max and min characters

```
out.println((int)Character.MIN_VALUE);
out.println((int)Character.MAX_VALUE);

out.println(Character.MIN_VALUE);
out.println(Character.MAX_VALUE);
```

MIN_VALUE and MAX_VALUE are very useful for contest programming.

OUTPUT

0
65535
?
?

charsminmax.java

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