

A+ Computer Science

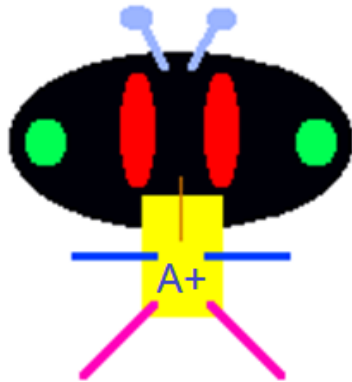
VARIABLES

References

What is a reference?

A reference variable stores the memory address of an object.

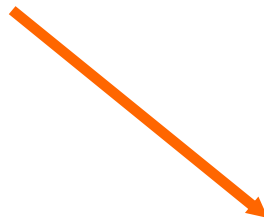
```
AplusBug cs = new AplusBug();  
AplusBug dude = new AplusBug();
```



What is a reference?

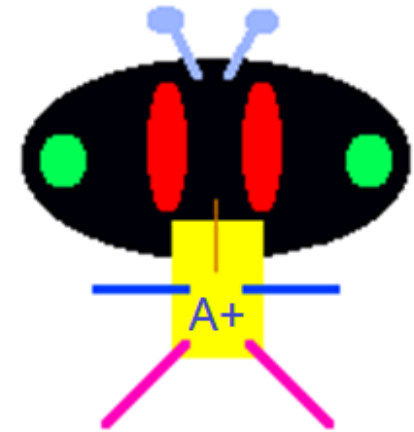
```
AplusBug cs = new AplusBug();
```

cs
0xF5



0xF5

AplusBug Object



cs stores the address of an AplusBug.

Variables



What is a variable?

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

```
int aplus = 254;  
double compsci = 10.25;  
char grade = 'A';
```

aplus

254

compsci

10.25

What is a variable?

```
int aplus = 254;
```

aplus

254

numDays stores an integer value

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;  
class B{ }
```

```
//very bad  
//very bad
```



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.

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.

identifiers.java

Types of Variables



What is a data type?

int double boolean

int whole

double fraction

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

What is a data type?

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
reference	32 bits	n/a

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

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

Characters

What is a character?

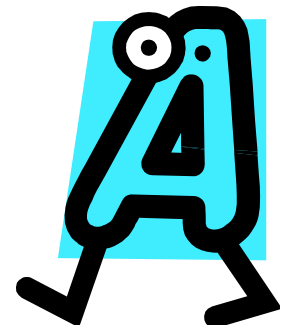
```
char let = 'A';  
char fun = 65;
```

```
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: 000000000110011

char let = 65;

ASCII VALUES YOU MUST KNOW!

'A' – 65

'a' – 97

'0' - 48

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!

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

Strings

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 (=).

Defining vs. Assigning

int **aplus;** ← **definition only**

int **aplus** = **99;** ← **definition and assignment**

aplus = **56;** ← **assignment only**

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

Data Types

Data Types

data type	memory usage	min .. max
byte	8 bits	-128 to 127
short	16 bits	-32768 to 32767
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float	32 bits	-big to +big
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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

16 bits = 0101 1001 0100 1001 = 2 bytes

The more bits you have the more you can store.

1 byte = 8 bits

101010100100000111
100001000011111001
10101010101011001



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

1.7976931348623157E308

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

Work on Programs!

Crank

Some Code!

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VARIABLES