From Algorithms to Program

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Objectives

At the end of the meeting, students should be able to:

- Create programs using the different operations on variables: assignment, arithmetic, comparison

From Algorithms to Program

A typical programming task can be divided into two phases:

- ***Problem solving phase***
  - produce an ordered sequence of steps that describe solution of problem
  - this sequence of steps is called an ***algorithm***
- ***Implementation phase***
  - implement the program in some programming language

Variables and their Types

- variables are used for the temporary storage of values in the computer's memory
- all variables are declared in a program along with their types
- most commonly used types are integers **(int),** floating point numbers with decimal points (**float)**, and characters **(char)**

Syntax

- basic syntax or format for variable declarations

<type> <one or more variables separated by commas>;

- Examples:

```
        int age;
        float inches, cm;
        char  middle_initial;
```

Variables and their Types

- We can combine these basic types to form more complex types, e.g., a list of integers, or a string of characters

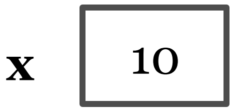
- Examples:

```
    int quizzes[5];
            /* up to five integers */
    char firstname[20], surname[20];
            /* up to 20 characters  long */
```

Operations on variables: assignment

- Data can be stored (and later retrieved) in variables

```
main()
{
    int x=10;
    printf(“%d”, x);
}
```



x 10

Stores 10 in the variable named x, then prints the contents of x

%d is the format code for an integer

Operations on variables: arithmetic

- Basic arithmetic (add +, subtract -, mult *, divide /, remainder %) can be performed

```
main()
{
    int x;
    printf("enter any integer: ");
    scanf("%d", &x);
    printf("%d %d %d %d %d",
            x+2, x-2, x*2, x/2, x%2);
}
```

Operations on variables: arithmetic

- Arithmetic expressions can be used in the right side of assignment statements

```
main()
{
    int x = 10, y, z;
    y = (2*x)+1;
    z = 2*(x+1);
    x = x+1;
    printf(“%d %d %d”, x, y, z);
}
```

Operations on variables: arithmetic

- Arithmetic expressions can be used in the right side of assignment statements

```
main()
{
    int x = 10, y, z;
    y = (2*x)+1;
    z = 2*(x+1);
    x = x+1;
    printf(“%d %d %d”, x, y, z);
}
```

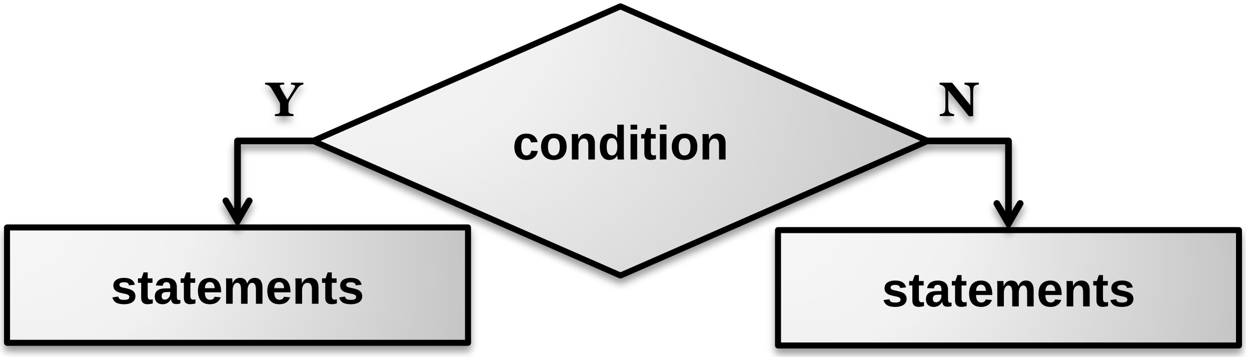
Example 1:

- Given 3 numbers in any order, find their average.

Operations on variables: comparisons

Syntax: (note: the else clause is optional)

```
if (condition) {
   statements to be performed if the condition is true;
}
else {
   statements to be performed if the condition is false;
}
```

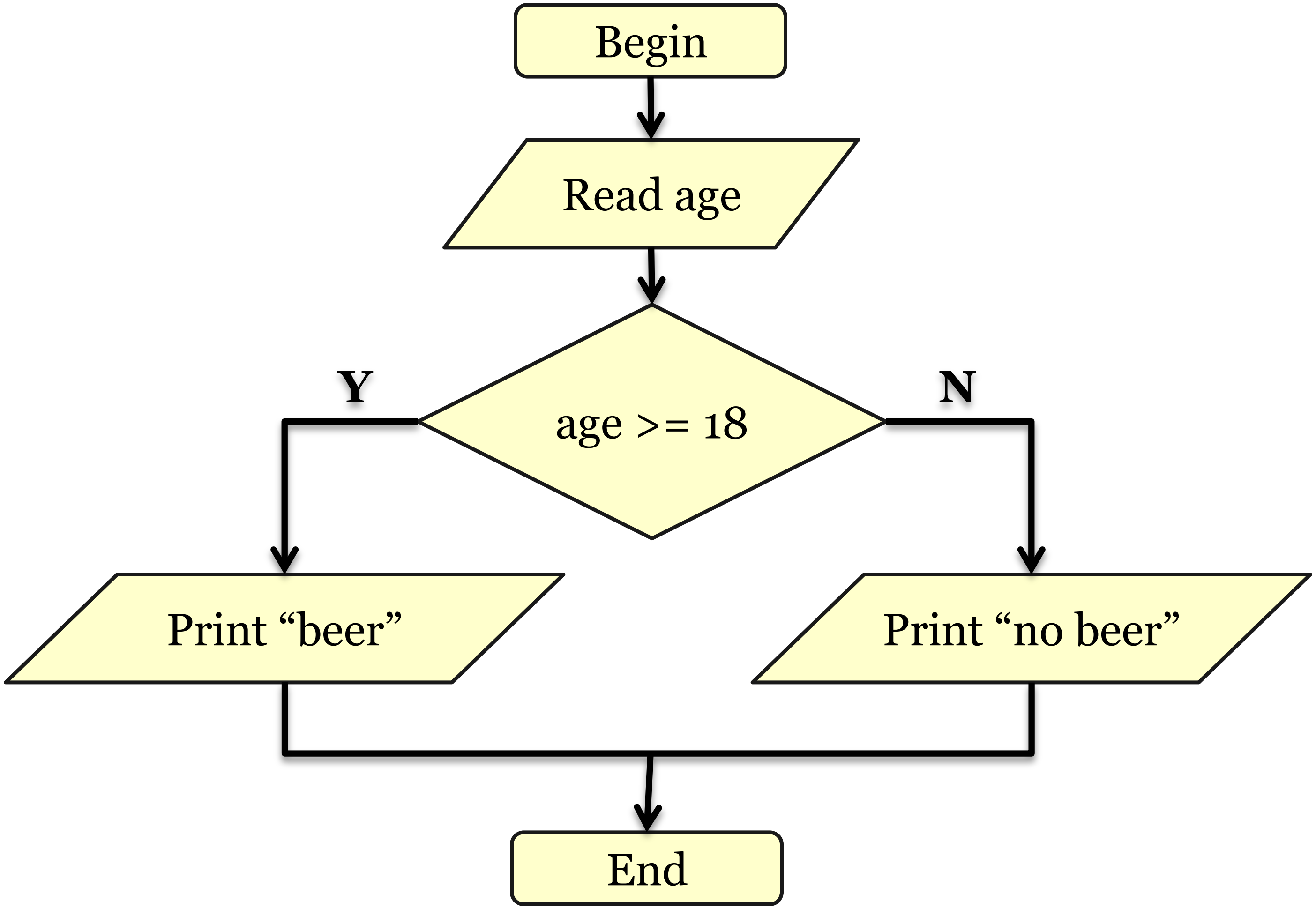


Operations on variables: comparisons

- a condition is a logical (or Boolean) expression which evaluates to either true or false;
- relational operators are often used for comparing values of expressions

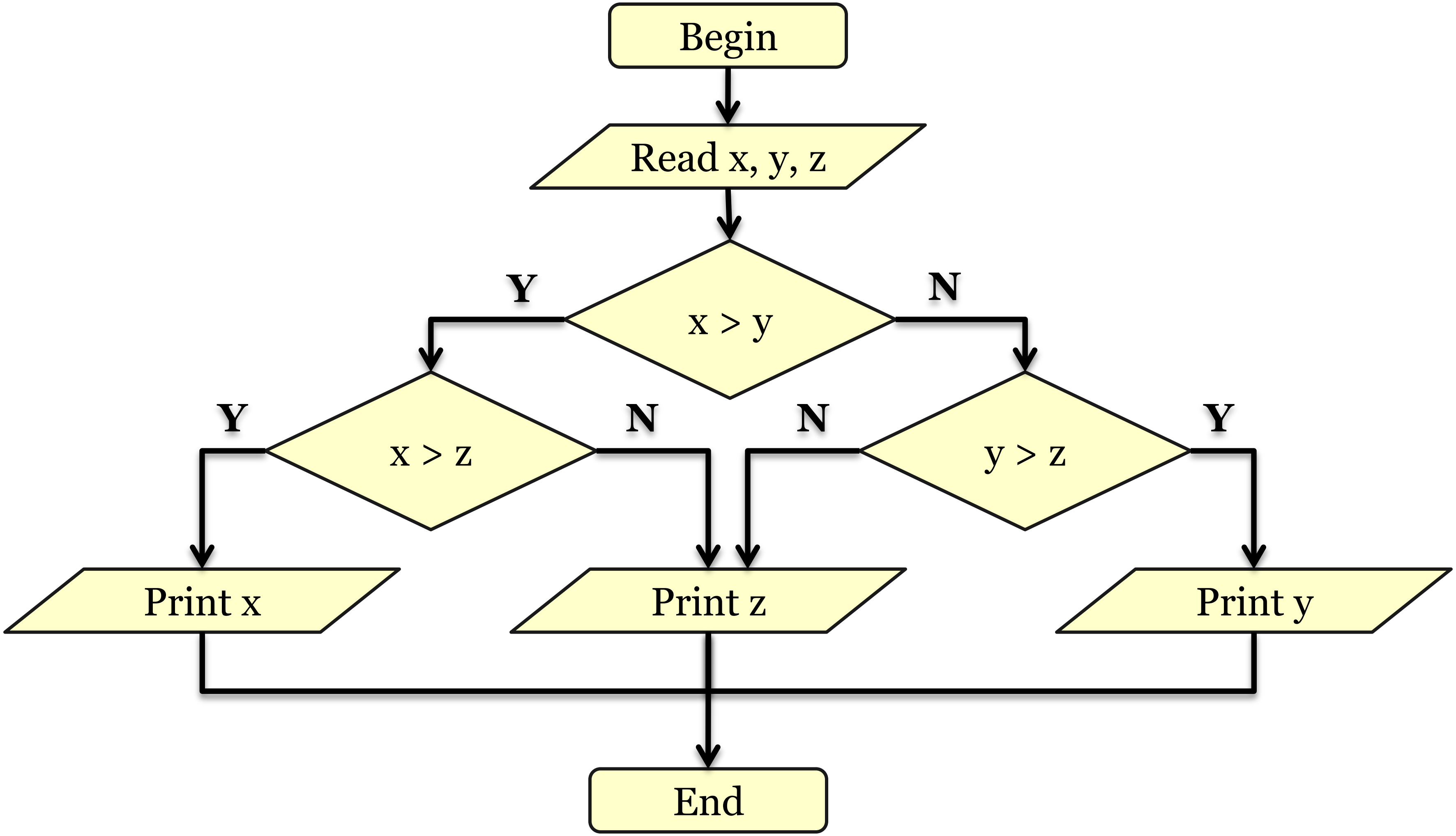
==	equal
<	less than
<=	less than or equal
!=	not equal
>	greater than
>=	greater than or equal

Example 2:



Example 3:

- Input any 3 numbers (in random order), and find and print the largest value.


Begin
Read x, y, z
x > y
Y
N
x > z
Y
N
y > z
N
Y
Print x
Print z
Print y
End

Example 4:

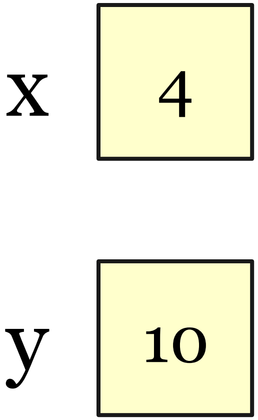
Enter a temperature in Fahrenheit, convert and print the equivalent temperature in Celsius, and output exactly one of the following messages: “too cold” (< 10C), “too hot” (> 40C), or “just right” (greater that or equal to 10C but less than or equal to 40C).

Example 5:

Input any 2 numbers (in random order), and print them in sorted (ascending) order.

How do you swap two numbers?

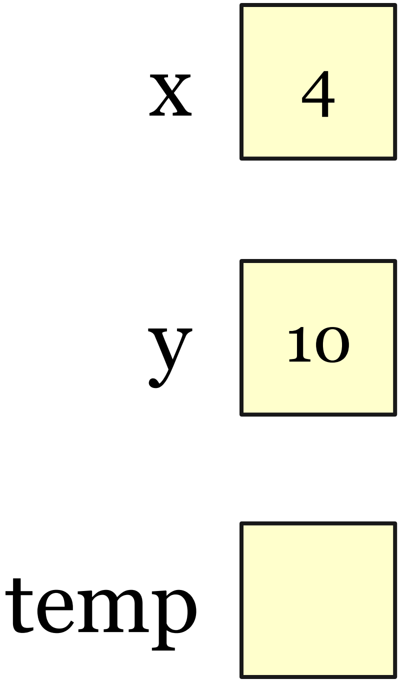
```
x = y;
y = x;
```



What will be the value of `x` and y after the two statements?

How do you swap two numbers?

We need another variable.



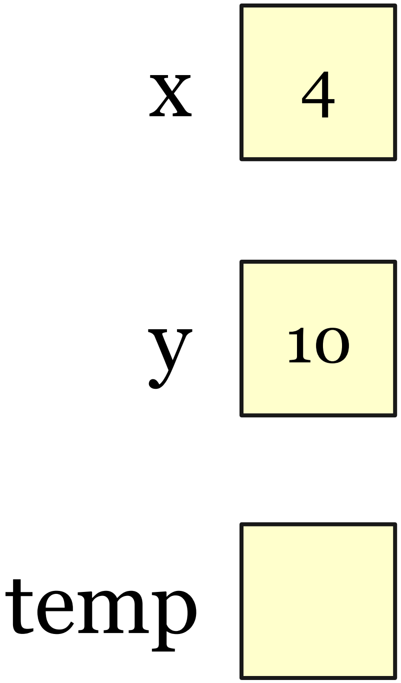
x 4

y 10

temp

How do you swap two numbers?

before `x = y`,
we save the value
of x to temp
(`temp = x`)



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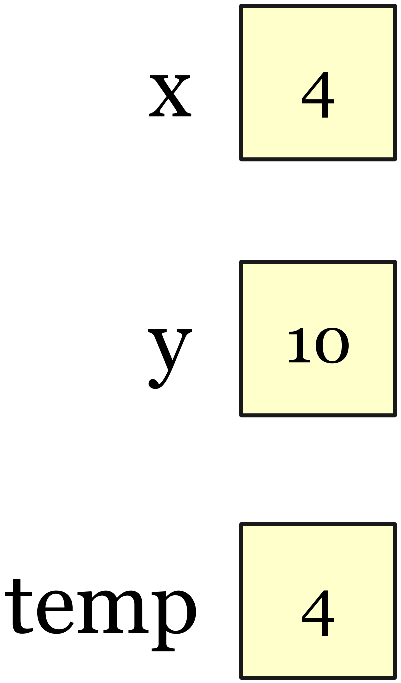
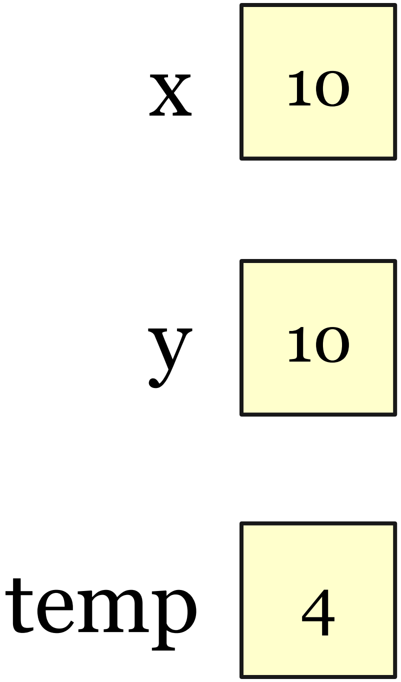


How do you swap two numbers?

```
temp = x
x = y
```



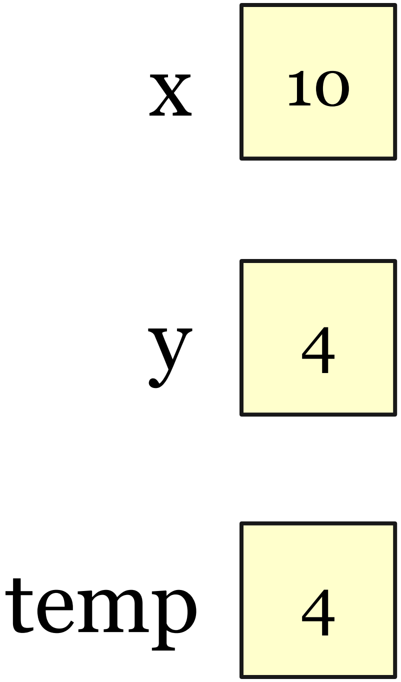
x 10

y 10

temp 4

How do you swap two numbers?

```
temp = x
x = y
y = temp
```



Example 6:

Input any 3 numbers (in random order), and print them in sorted (ascending) order.

Hint: One possible algorithm is to do the ff.

{ *sort the first adjacent pair; sort the last adjacent pair; sort again the first adjacent pair;* }

Next meeting…

- Programming with Iteration

END