Control structures – sequence

- Do a block of steps in the given order

```
{
 wake_up;
 dress_up;
 go_to_school;
}
```

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Sequence control structures – selection (or branching with if-else)

- Evaluate the condition and perform a block of steps if the condition is true (otherwise perform the other block of steps)

```
if ( today_is_a_school_day )     /* condition that may be T or F */
{
     wake_up;                    // if a school day …
     dress_up;                   // note the indentation to
     go_to_school;               //    improve code readability
}
else
{
     sleep_all_morning;          // if not a school day …
}                                // curly braces are optional for
                                 //    a single-step block
```

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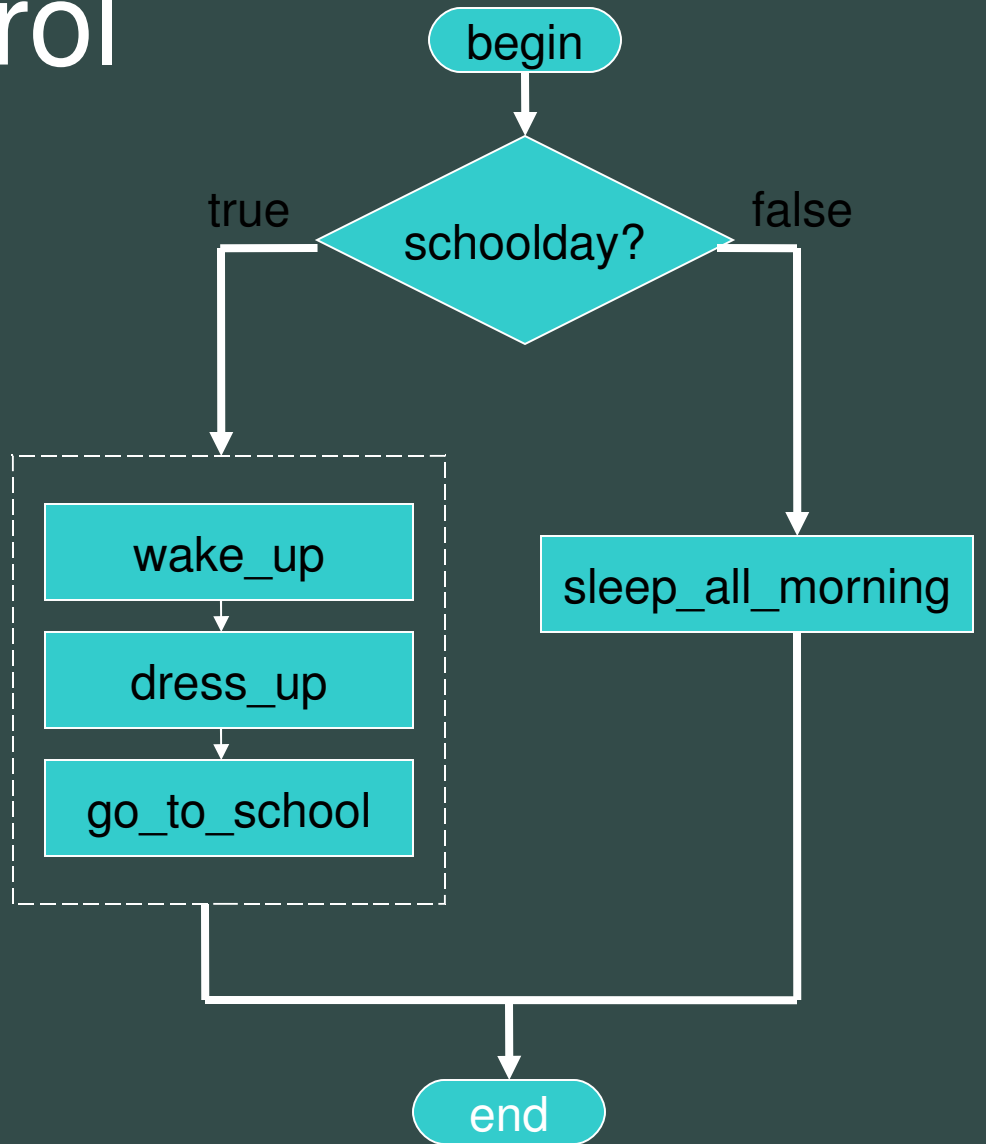
Flowcharts help us to visualize the flow of control

```
if ( today_is_a_school_day )
{
    wake_up;
    dress_up;
    go_to_school;
}
else
    sleep_all_morning;
```



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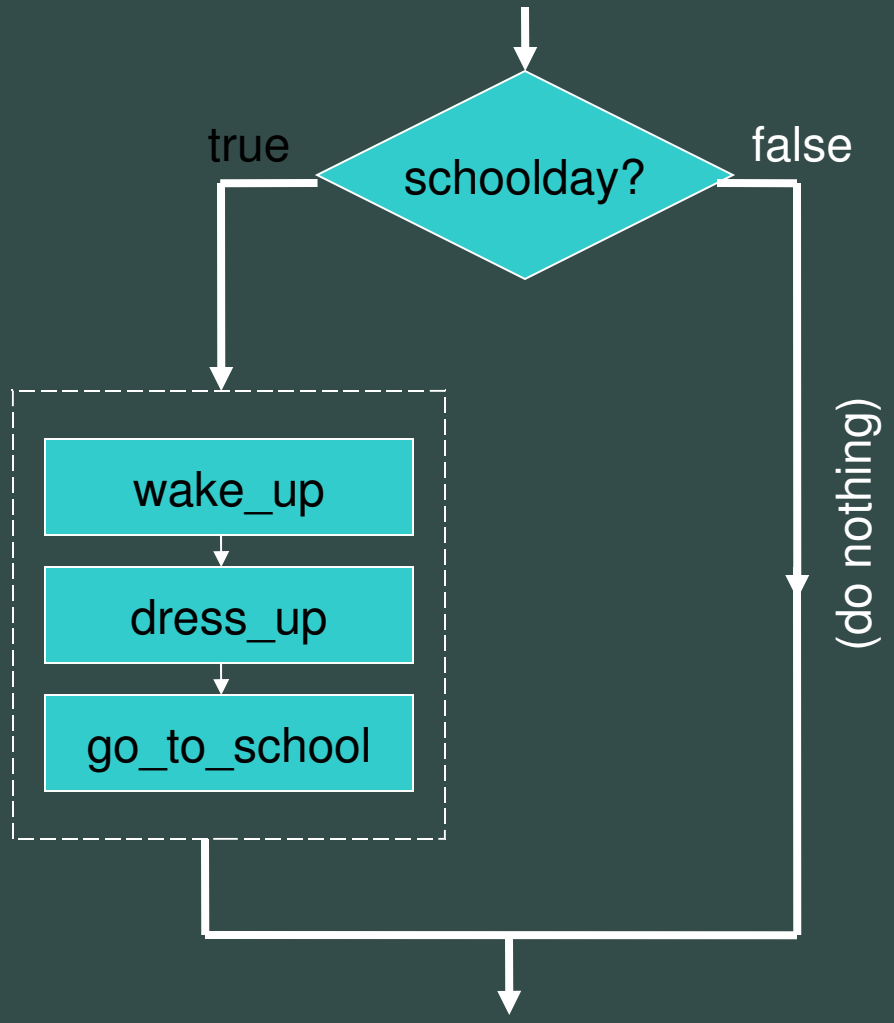
A branch can be empty

```
if ( schoolday )
{
    wake_up;
    dress_up;
    go_to_school;
}
```



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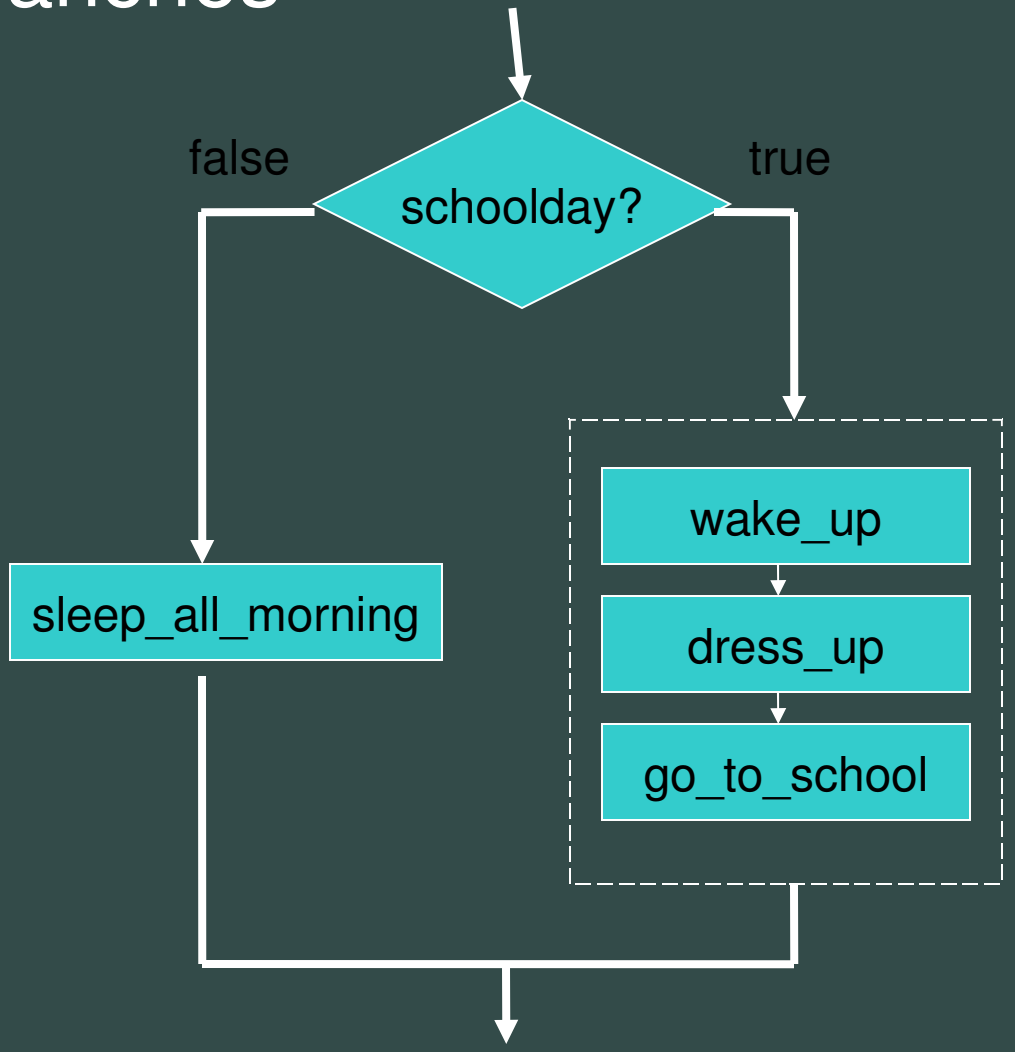
Use negation (!) in the condition to reverse the two branches

```
if ( !schoolday )
{
        sleep_all_morning;
}
else
{
        wake_up;
        dress_up;
        go_to_school;
}
```



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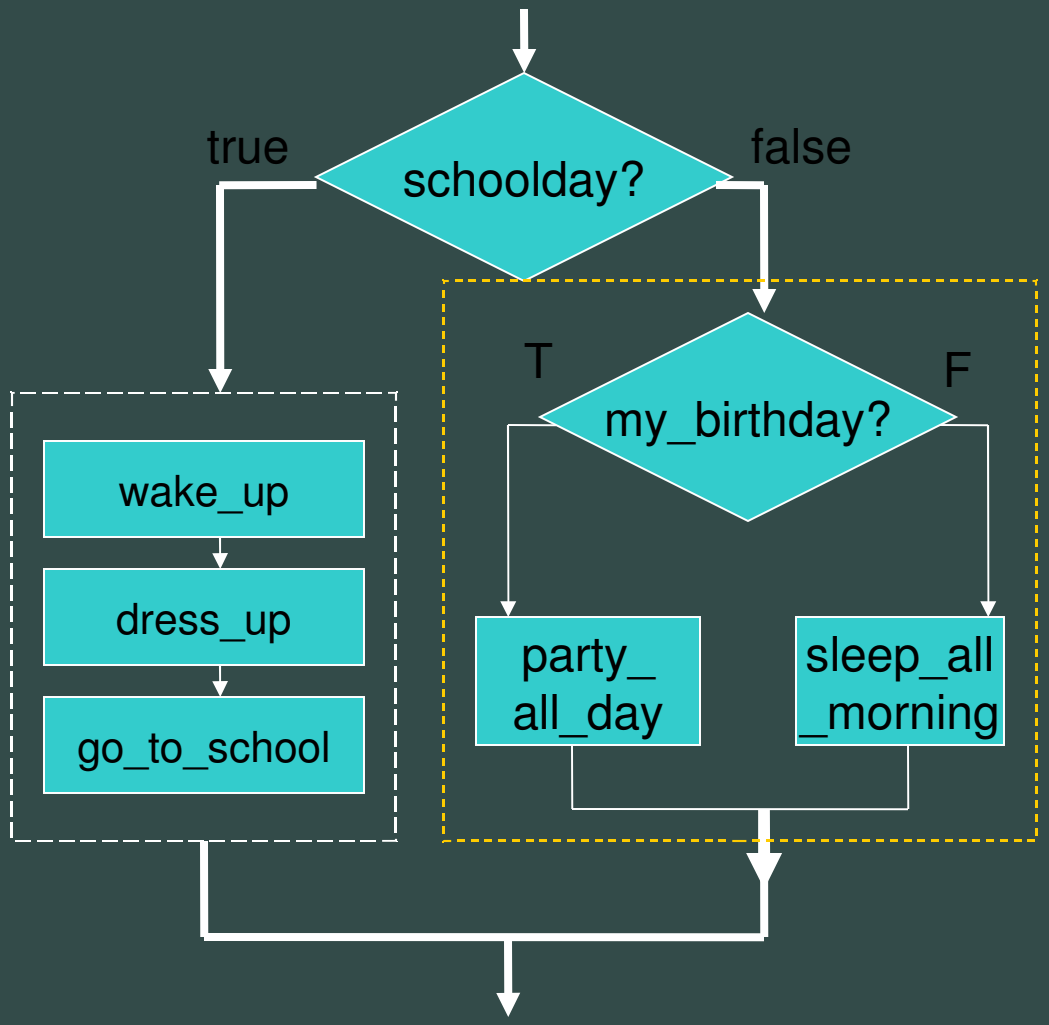
A branch can have more branches

```
if ( today_is_a_school_day )
{
        wake_up;
        dress_up;
        go_to_school;
}
else
{
        if ( my_birthday_today )
        {
                party_all_day;
        }
        else
        {
                sleep_all_morning;
        }
}
```



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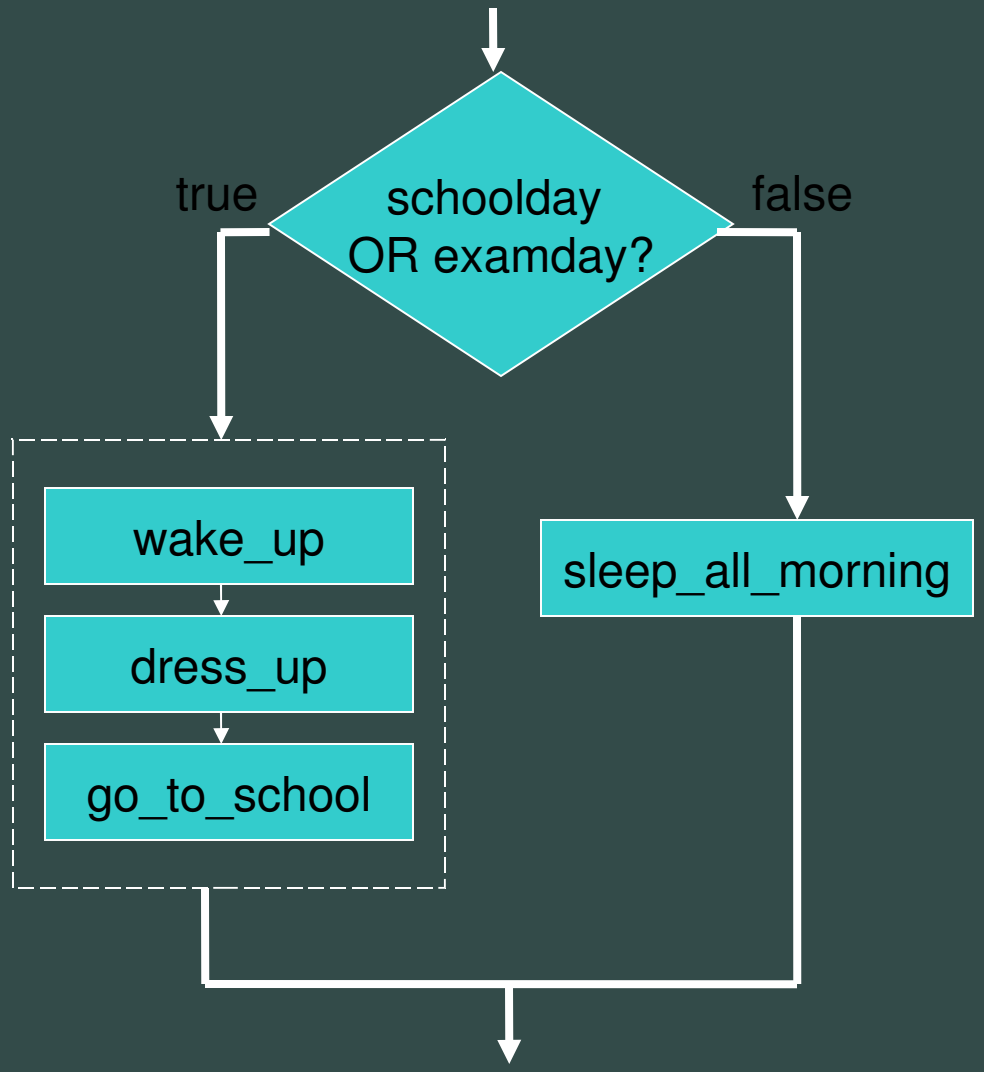
Conditions can be simple, or complex with the use of logical operators

```
if ( schoolday || examday )
{
      wake_up;
      dress_up;
      go_to_school;
}
else
{
      sleep_all_morning;
}
```



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Remember truth tables in mathematical logic

- **!** Means NOT
  - (!A) is true if and only if A is false
- && means AND
  - (A && B) is true if and only if both A and B are true
- || means OR
  - (A || B) is true if and only if at least one of A or B is true

A	B	A && B	A || B
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	F

A	!A
T	F
F	T

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Exercise: Be sure you understand the logical operators. Would the two algorithms below behave in the same way?

```
if  ( schoolday || examday )
{
        wake_up;
        dress_up;
        go_to_school;
}
else
        sleep_all_morning;
```

```
if  ( schoolday )
{
        wake_up;
        dress_up;
        go_to_school;
}
else
{
    if ( examday )
    {
        wake_up;
        dress_up;
        go_to_school;
    }
    else
        sleep_all_morning;
}
```

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Another example

(good indentation helps improve code readability)

```
if ( you wish to access these notes electronically yourself )
{
    find a computer with a fast Internet connection
    if ( !( you have an account at courses@uplb ) )
    {
        use any web browser and go to courses.uplb.edu.ph
        follow the instructions to create your own account
    }
    download the files that you need
}
else
{
    find a friendly classmate who can share a copy
    smile and thank your friend
}
```

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Sequence control structures – loops

- Branching with if-else is nice but we need something more powerful in order to do more
- Loops allow some block of statements to be performed repeatedly
- There are several ways of expressing loops, all are useful

```
{   // instructions for a nerdy brand of shampoo
   wet_hair;
   do {
        apply_shampoo;
        massage_into_hair_and_scalp;
        rinse_well;
   } while ( dirty );   // repeat if necessary
   towel_dry;
}
```

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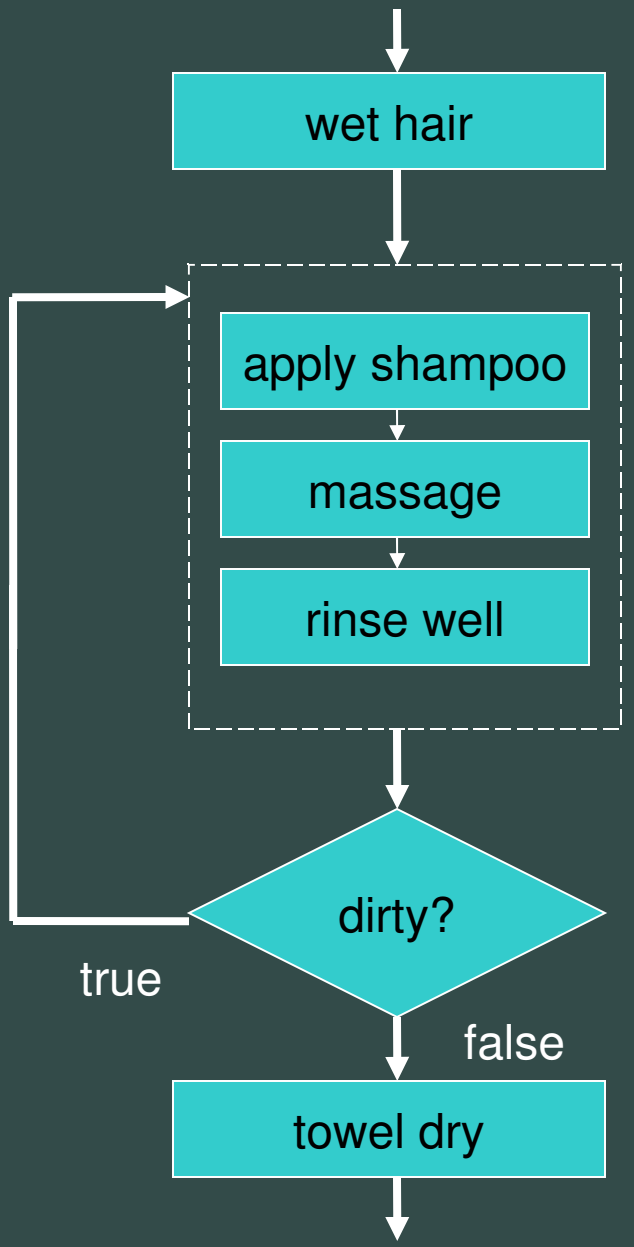
An example of a loop

```
{
   wet_hair;

   do {
       apply_shampoo;
       massage_into_hair_and_scalp;
       rinse_well;
   } while ( dirty );   // repeat if necessary

  towel_dry;
}
```



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