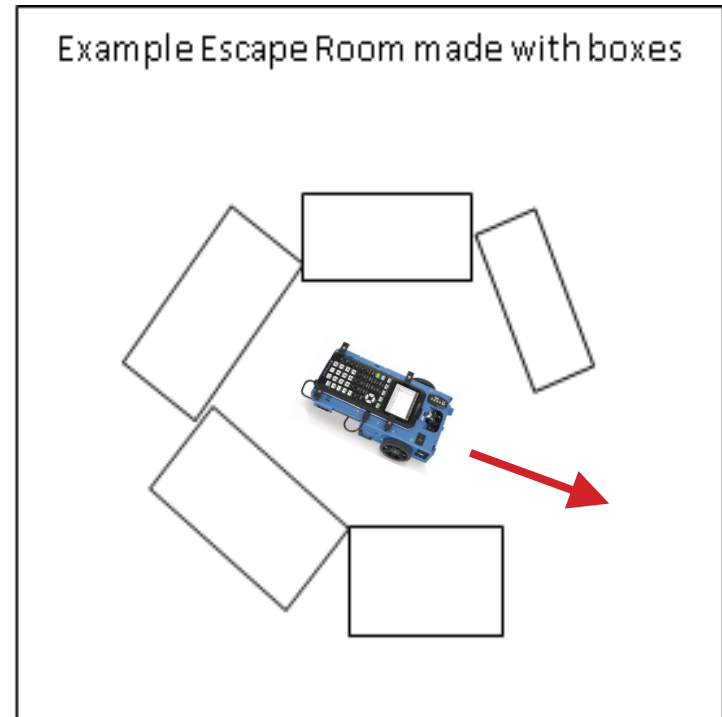


Rover, escape the room!

Texas Instruments
@ticalculators
#tiinnovator

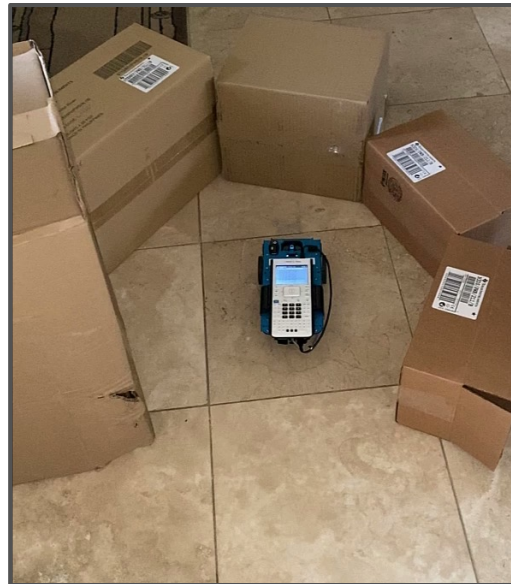
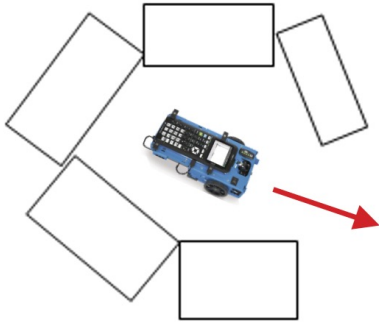


See projects at www.TIstemProjects.com
Contact STEM-team@ti.com with questions

Write a program to help Rover escape

New Program:

Example Escape Room made with boxes

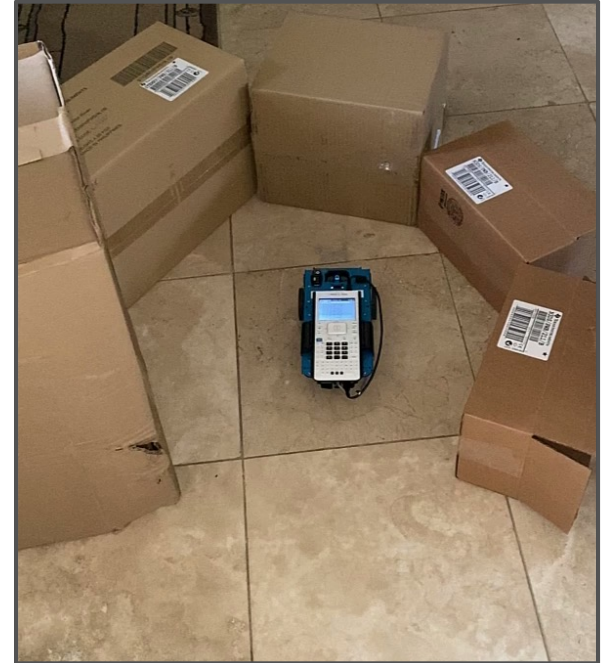


Task: Use the ranger to find the opening in a set of boxes and have Rover escape through the opening.

You will need to read the heading for each turn and compare the ranger measurements to determine where the opening is.

Some questions to think about

- » What will Rover measure?
- » How will you instruct Rover “look” for a gap?
- » How will Rover know there is a gap?
- » Will you have Rover
 - » escape as soon as a gap is detected or
 - » will you look at all the options before deciding where to drive?
- » How will Rover “remember” the location of a gap?
- » How will you instruct Rover to drive through a gap?
 - » Are there patterns in the Rover behavior that your program can adjust for?
- » What will you do if there is no gap in the wall?



Write your own program

Purpose

What is the purpose of your program?

Name

What is the name of your program?

Inputs

What input values or measurements will you need?

Variables

*What variables will you need?
What will you call them?*

Calculations and Control Statements

*What calculations will you need?
What conditional logic statements will you need?
What loops will you need?*

Outputs

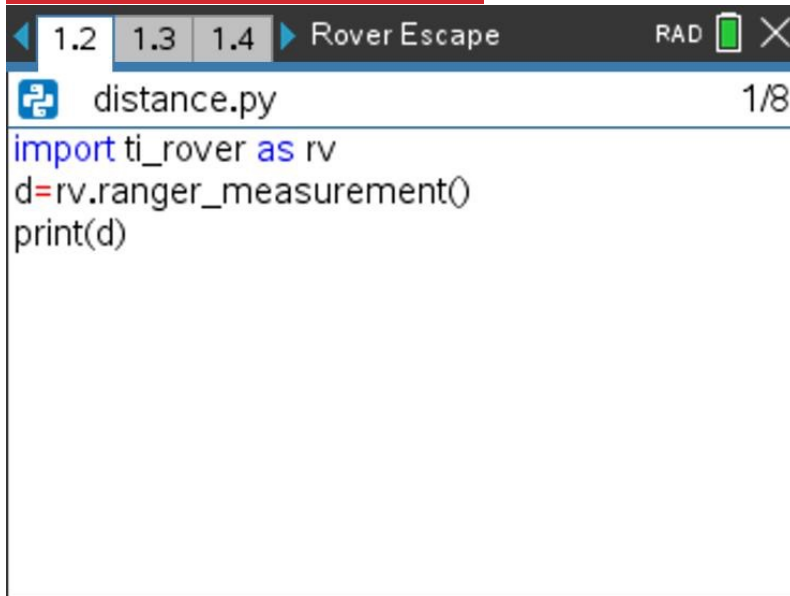
*What values will you print?
What physical outputs will you make?*

Modules: *What modules (if any) do you need to import?*

BUILDING UP TO THE FINAL CHALLENGE

How far away is that?

New Program:



```
1.2 1.3 1.4 Rover Escape RAD [Battery Icon] [Close Icon]
distance.py 1/8
import ti_rover as rv
d=rv.ranger_measurement()
print(d)
```

Task: Use the Rover ranger to detect distance to an object and display the distance on the screen

What is the unit of measurement reported by the ranger?

What distance measurements do you see when the Rover is pointed at different places on the enclosure wall?

What distance measurements do you see when Rover is pointed at a gap in the wall?

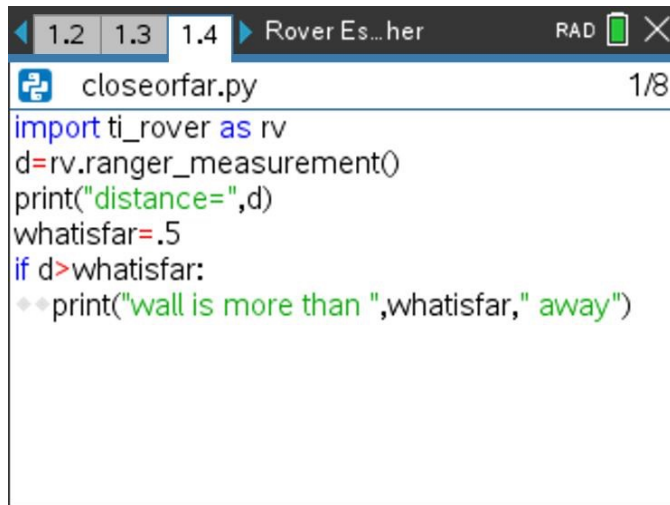
Find `rv.ranger_measurement()` on the TI-Rover 3:Inputs menu

Store a value to a variable with “=”

Find `print()` on the Built-ins 6:I/O menu

Am I close or far?

New Program:



```
1.2 1.3 1.4 Rover Es...her RAD X
closeorfar.py 1/8
import ti_rover as rv
d=rv.ranger_measurement()
print("distance=",d)
whatisfar=.5
if d>whatisfar:
    print("wall is more than ",whatisfar," away")
```

Task: Use the Rover ranger to detect distance to an object, print the distance.

Have the Rover “decide” if the object is far away. Print an alert message.

Try different values for the *whatisfar* variable.

Find the **if** statement [menu] Built-ins 2:Control 1:if..:

If the logic statement at the beginning of the if block is true the program runs the block.

If the logic statement is false, then the block is skipped.

The block starts with a colon and includes all of the indented statements.

The value for the variable ***whatisfar*** determines what is considered to be far or close.

The print() function can take multiple inputs separated commas.

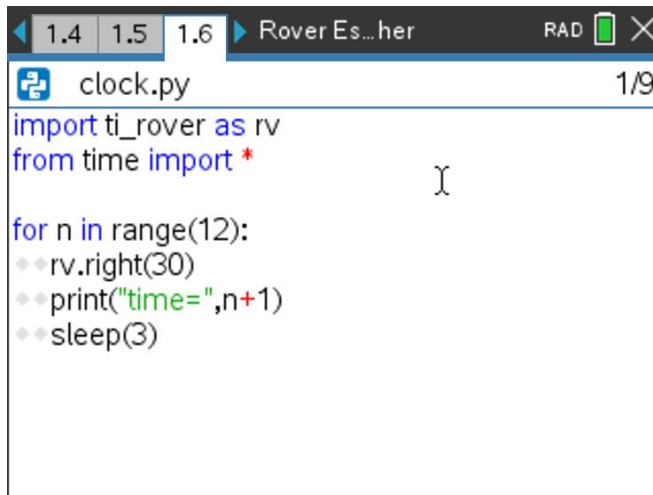
Text strings are a set of characters enclosed in quotes. The exact characters are printed.

The quote symbol is entered on the keyboard by [ctrl] [multiple]

A variable name refers to a value. The current value of the variable is printed.

What time is it?

New Program:



```
clock.py 1/9
import ti_rover as rv
from time import *

for n in range(12):
    rv.right(30)
    print("time=",n+1)
    sleep(3)
```

Task: Use Rover to turn the hours of a clock.

Make Rover turn clockwise and stop on every hour of the clock for a 12 hour clock.

Print the current time.

What angle should the Rover turn to stop at twelve hour marks?

Why do we print $n+1$ for the current hour?

Put the Rover inside your room. Add statements to measure and print distance to the wall at each hour. What patterns do you see in the measurements?

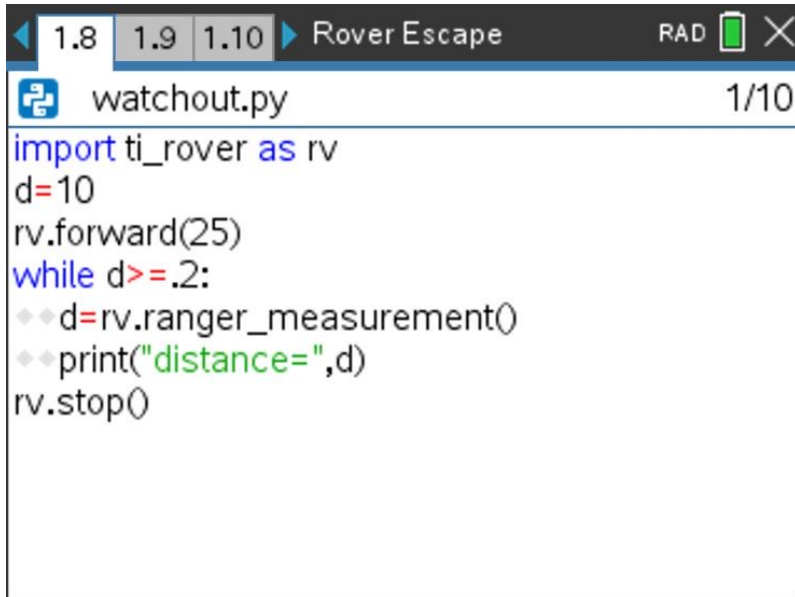
If you finish early, create a way to show a 24 hour clock.

Import the time module at [menu] A:More Modules 2:Time to have access to the sleep() function.
Find sleep() on the TI-Rover 7:Commands menu
The sleep() function pauses the program for the number of seconds of the input value in parentheses

Find the **for loop** statement [menu] Built-ins 2:Control 4:for index in range(size):
A for loop repeats a block of code a known number of times set by the value of the range size.
The loop repeats statements in the indented block beginning with a colon.
The index variable n begins at zero and increases by 1 after each loop.
Looping stops when n is equal to or greater than the loop size.

Watch Out!!!

New Program:



```
import ti_rover as rv
d=10
rv.forward(25)
while d>=.2:
    d=rv.ranger_measurement()
    print("distance=",d)
rv.stop()
```

Task: Drive Rover at an object and stop prior to the collision.

Use the ranger to detect when Rover is within 20 cm (.2 meters) of an obstacle and stop.

Try different values for the stop distance.

Find the **while loop** statement [menu] Built-ins 2:Control 8:while..:

A while loop repeats a block of code as long as the initial condition is true. The number of repetitions is unknown.

The loop repeats statements in the indented block beginning with a colon.

The loop continues to repeat as long as the initial statement checks as true.

When the loop stops, the program moves on to the line just after the loop

The print() function can take multiple inputs separated by commas.

Text strings are a set of characters enclosed in quotes. The exact characters are printed.

The quote symbol is entered on the keyboard by [ctrl] [multiple]

A variable name refers to a value. The current value of the variable is printed.

FINAL CHALLENGE

Escape now

New Program:

```
rvescapenow.py
import ti_rover as rv
from time import *
# Set the initial values of variables
# What is a value for the distance measurement
# that shows a gap?
# Have Rover look for a gap in the wall
# Use a While loop to look until you find a gap
# What statement is true if the Rover
# is looking at a wall?
# What is a useful angle for Rover to turn?
# Drive through the gap
```

Task: Use the Rover ranger to detect a gap in the wall and drive through it.

What is the distance measurement when Rover is pointed at a gap in the wall.

Are there patterns in the Rover behavior that your program can adjust for?

How would you modify your program to handle the situation when there is no gap?

Drive through the maximum gap

New Program:

```
rvescmaxdistance.py
import ti_rover as rv
from time import *
# Set the initial values of variables

# Look for the maximum gap in the wall
# Use a For loop to find the maximum gap.
# How many times should the loop repeat?
# What angle should Rover turn?
# Check to see if the current measurement
# is greater than the maximum.
# If yes, update the maximum value.
# And update the n value of the maximum
# so that you can return later.

# Turn to the direction of the maximum gap
# and drive through the gap
```

Task: Use the Rover ranger to detect the maximum gap in the wall and drive through it.

Are there patterns in the Rover behavior that your program can adjust for?

How would you modify your program to handle the situation when there is no gap?

FINAL CHALLENGE EXAMPLES

Escape now

New Program:

```
rvescapenow.py
import ti_rover as rv
from time import *
# Set the initial values of variables
# What is a value for the distance measurement
# that shows a gap?
d=0
gapdistance=.5
# Have Rover look for a gap in the wall
# Use a While loop to look until you find a gap
# What statement is true if the Rover
# is looking at a wall?
# What is a useful angle for Rover to turn?
while d<gapdistance:
    rv.right(30)
    sleep(2)
    d=rv.ranger_measurement()
# Drive through the gap
rv.forward(10)
```

Task: Use the Rover ranger to detect a gap in the wall and drive through it.

What is the distance measurement when Rover is pointed at a gap in the wall.

Are there patterns in the Rover behavior that your program can adjust for?

How would you modify your program to handle the situation when there is no gap?

Drive through the maximum gap

New Program:

```
rvescmaxdistance.py
import ti_rover as rv
from time import *
# Set the initial values of variables
maxd=0
n_of_maxd=0
# Look for the maximum gap in the wall
# Use a For loop to find the maximum gap.
# How many times should the loop repeat?
# What angle should Rover turn?
# Check to see if the current measurement
# is greater that the maximum.
# If yes, update the maximum value.
# And update the n value of the maximum
# so that you can return later.
for n in range(12):
    rv.right(30)
    sleep(2)
    d=rv.ranger_measurement()
    if d>maxd:
        maxd=d
        n_of_maxd=n
# Turn to the direction of the maximum gap
# and drive through the gap
rv.right((n_of_maxd+1)*30)
rv.forward(10)
```

Task: Use the Rover ranger to detect the maximum gap in the wall and drive through it.

Are there patterns in the Rover behavior that your program can adjust for?

How would you modify your program to handle the situation when there is no gap?