WORKSHEET

3.1 What a controller is

BugBotLab

Control · Robot club · about 15 min

Name _____ Class _____ Date _____

What this lesson is about

The error and its sign, wrapping headings, bang-bang control, overshoot.

- The error
- The simplest controller: bang-bang
- Overshoot
- Fixing it the crude way

Questions

7 marks in all

1. What does this program print? [1 mark]

```
def wrapped(h):
    return (h + 180) % 360 - 180

print(wrapped(200))
print(wrapped(350))
```

2. A controller uses `error = target - measured`. The target heading is 90 and the robot faces 60. What is the error? Give a whole number. [1 mark]

3. What is bang-bang control? [1 mark]

- ☐ **A** Looking at the sign of the error and going that way at a fixed speed
- ☐ **B** Pushing harder the bigger the error is
- ☐ **C** Driving into a wall and backing off
- ☐ **D** Turning on and off at random

4. The bang-bang loop calls `stop()` when the error is under 2 degrees, but the robot ends further off. Why? [1 mark]

- ☐ **A** The robot keeps turning for a moment after stop()
- ☐ **B** The heading sensor is wrong
- ☐ **C** wrapped() gives the wrong answer
- ☐ **D** abs() removes the sign

5. What does this program print? [1 mark]

```
for error in [30, -10]:
    speed = 60 if abs(error) > 25 else 20
    print(error, speed)
```

6. What does `break` do inside `while True:`? [1 mark]

- ☐ **A** Leaves the loop
- ☐ **B** Stops the robot's motors
- ☐ **C** Pauses the loop for a moment
- ☐ **D** Starts the loop again from the top

7. What is the problem with the crude fix: fast when far, then short slow bursts with a pause? [1 mark]

- ☐ **A** It works, but it is slow at the end
- ☐ **B** It never gets within 2 degrees
- ☐ **C** It spins the wrong way
- ☐ **D** It only works for heading 0

The task: face north

Spin until the robot faces 0 within 3 degrees, printing `error:` and the error every time round the loop. Do not drive anywhere.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

print("heading:", heading())
```

Plan your program here, then type it in and press Run.

Do it on the robot

www.bugbotlab.com/learn/3-1-what-a-controller-is/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Count how many times the loop ran and print it at the end.
2. Face 90, then 180, then 270, then 0 with the same loop and a `for` over the targets.
3. Find the fastest spin speed that still stops within 3 degrees using the crude fix.