UNIVERSITY OF TWENTE.

APPLICATION DEVELOPMENT

LECTURE 8: PRACTICE EXAM

```
class AppDev {
}
```

Part of SmartProducts

INTRODUCTION

APPLICATION DEVELOPMENT

- Prototype, report, etc.
- Practice exam

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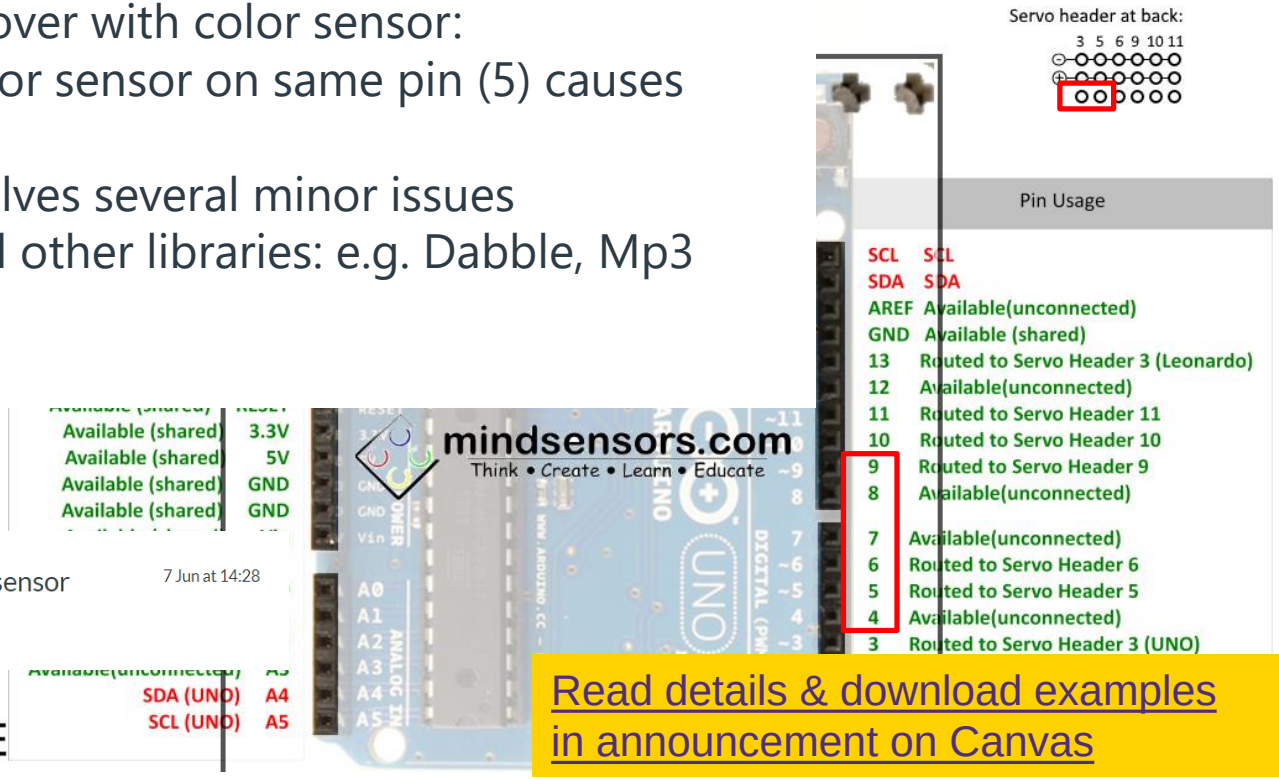
slides @ vanslooten.com/appdev

NEW EXAMPLES GIVEN

ANNOUNCEMENT ON CANVAS LAST WEEK

Example of more efficient Rover with color sensor:

- Ultrasonic sensor and color sensor on same pin (5) causes conflict
- Uses less memory and solves several minor issues
- Allows addition of several other libraries: e.g. Dabble, Mp3 player



Example of more efficient Rover with color sensor

7 Jun at 14:28

Fjodor van Slooten

All sections

UNIVERSITY OF TWE

[Read details & download examples in announcement on Canvas]

PROTOTYPE
FOR PROJECT

- When to demonstrate
  - At exam: to Tutor & Co-examiner
- All functions (not only interface)
  - Eg. driving, sensing, parent control etc…
  - You may simulate things, or make them simpler (Wizard of Oz)
  - Be clear/honest on this and ask permission of tutor

REPORT

- See remarks in presentation of last week (slide 10)
  - Design, rationale, …
- Hand-in all code as digital Appendix (zip-file)
  - Also hand-in Axure files (.rp), link to Figma prototype, diagrams, Eclipse project, Arduino sketch (whole folders!) etc.

How to hand-in as zip-file is explained here

HAND-IN BOXES

Hand in: Thursday **July 4th 12:00-13:00h** at entrance Noord-horst (in front of room **N258**)

- Break down the prototype and remove added materials (cardboard, wood, duct tape, etc.)
- Fill in online checklist (on July 4th, before you return the box)
- Remove all extra (borrowed) materials and batteries from box, put them on top of the lid

The final grade for the project will only be registered after all the materials that are borrowed from the UT are returned.

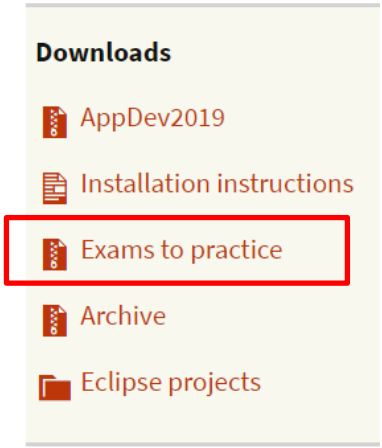
PRACTICE EXAM

Exam: Monday July 1th 8:45

Location to be announced (in schedule and rooster)

- 2 full exams of last year with answers:

downloads @ vanslooten.com/appdev

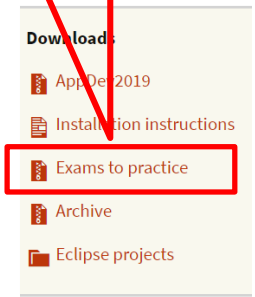


PRACTICE EXAM

APPENDIX

Exam: Monday July 1th 8:45
Location will be in rooster soon

Get the complete appendix from the zip-file with practice exams



Appendix: Shortened API documentation for exam of Application Development.

This documentation is based on docs.oracle.com/javase/8/docs/api

java.lang

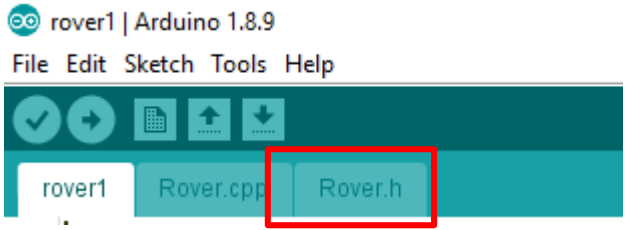
Class Math

Field Summary	
static double	E The double value that is closer than any other to *e*, the base of the natural logarithms.
static double	PI The double value that is closer than any other to *pi*, the ratio of the circumference of a circle to its diameter.

Method Summary	
static double	abs(double a) Returns the absolute value of a double value.
	Returns the natural logarithm (base *e*) of a double value.
static double	pow(double a, double b) Returns the value of the first argument raised to the power of the second argument.
static double	random() Returns a double value with a positive sign, greater than or equal to 0.0 and less than 1.0.
static int	round(float a) Returns the closest int to the argument.
static double	sin(double a) Returns the trigonometric sine of an angle.
static double	sqrt(double a) Returns the correctly rounded positive square root of a double value.
static double	tan(double a) Returns the trigonometric tangent of an angle.

PRACTICE EXAM

APPENDIX




```
#define TRIGGER_PIN  3  // Arduino pin tied to trig. pin on ultrasonic sensor
#define ECHO_PIN     5  // Arduino pin tied to echo pin on ultrasonic sensor
#define MAX_DISTANCE 300 // Maximum distance we want to ping for (in
centimeters). Maximum sensor distance is rated at 400-500cm.

#include <Wire.h>
#include <EVShield.h>
#include <EVs_NXTTouch.h>
#include <NewPing.h>

/**
  @brief This class interfaces with EVShield to create a mobile robot.
  Setup:
    - Two motors to drive, connected to Bank A of the EVShield
    - One motor on which the ultrasonic sensor is mounted: M1 on Bank B
    - Touch sensor on port as specified in the Rover::init() method in
Rover.cpp
*/
```

Get Explorer.h from Assignment 4a

```
class Rover {
  // class variables:
private:
  // pointers to objects created in main sketch:
  EVShield * evshield;
  NewPing * sonar;
  EVs_NXTTouch * touch;

public:
  SH_Motor steerMotor = SH_Motor_1; // motor (M1) on Bank B used for steering front
wheels
  SH_Motor sensorMotor = SH_Motor_2; // motor (M2) on Bank B on which the ultrasonic
sensor is mounted

  // speed and driving:
  int start_speed = 15;  // start speed (speed can be any value between 0-100)
  int speed=start_speed;
  boolean dr_forward = false, dr_backward = false; // moving in forward or backward
direction

  // car dimension:
  unsigned int car_rear_track = 145; // car's rear track, the distance between the
centerline of each rear wheel (in millimeters)
  unsigned int car_wheelbase = 185; // car's wheelbase, the distance between the center
of the front wheels and the rear wheels (in millimeters)
  float car_wheel_diam = 4.96; // car's wheel diameter in cm (wheels attached to motors)

  // methods:

  void init(EVShield * s, NewPing * p, EVs_NXTTouch * t);

  // driving related methods:
  void increase_speed();
  void decrease_speed();
  void forward();
  void backward();
  void differentialDrive(SH_Direction dir, int degrees = 0);
  void drive(int distance = 0);
  void stop();
  void steer(int degrees = 12);
  void straight();
  void reverseDirection();

  // sensor related methods:
  void checkSensors();
  unsigned int readDistance(); // read the distance from the ultrasonic sensor
};
```

Prepare to vote

Internet

1

2

This presentation has been loaded without the Shakespeak add-in.
Want to download the add-in for free? Go to
http://shakespeak.com/en/free-download/.

TXT

1

2

Voting is anonymous

Which are valid variable names? (more than 1 answers possible)

A. Rover car

B. c:\folder

C. oneDollar

D. 4U

E. U2

F. xs4all

G. mousebutton

The question will open when you start your session and slideshow.

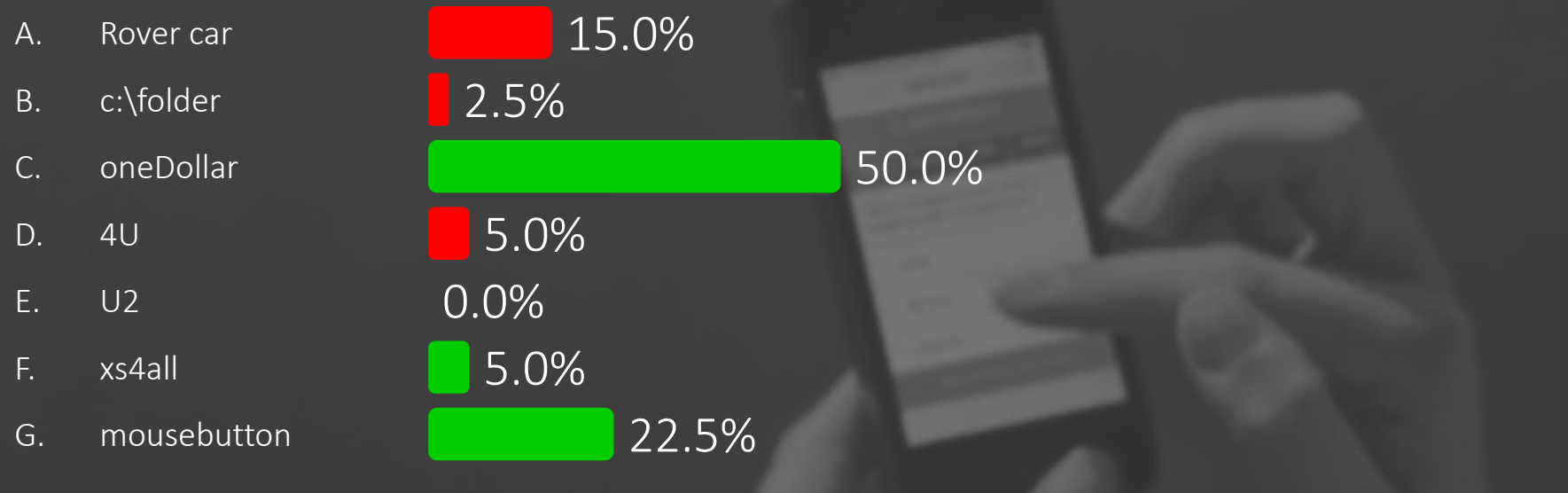
Votes: 40 ● Closed

Internet

TXT

This text box will be used to describe the different message sending methods. The applicable explanations will be inserted after you have started a session.

Which are valid variable names? (more than 1 answers possible)



In Java, there is a common practice in terms of naming code parts. What is this part?: **`readDistance()`**

A. Class
B. object
C. method
D. variable

The question will open when you start your session and slideshow.

Votes: 39 ● Closed

Internet
TXT
This text box will be used to describe the different message sending methods.
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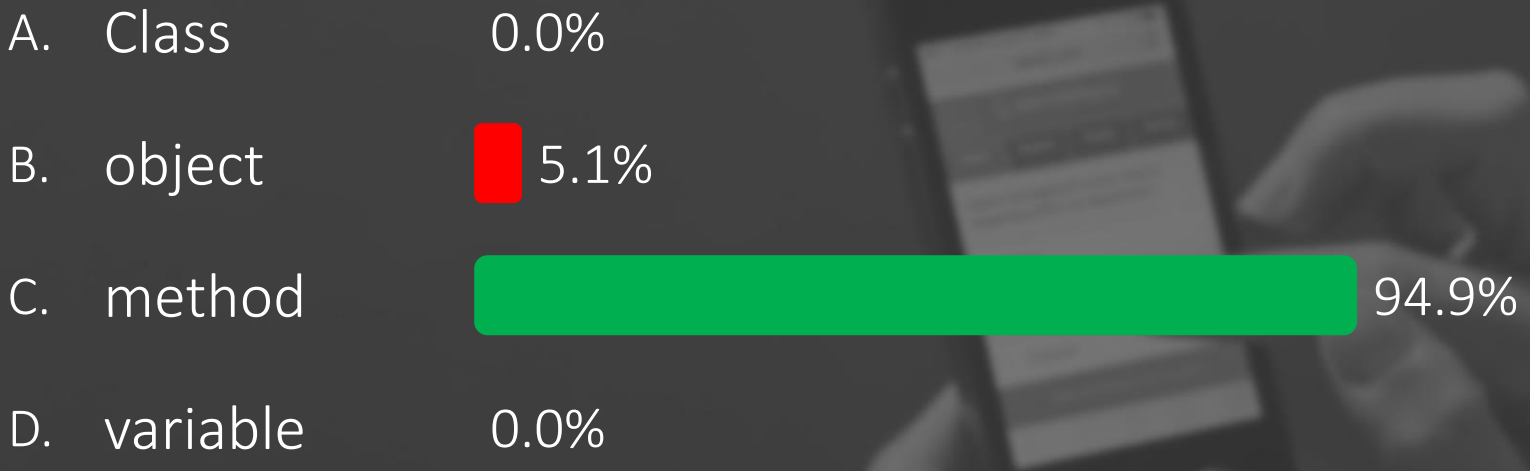
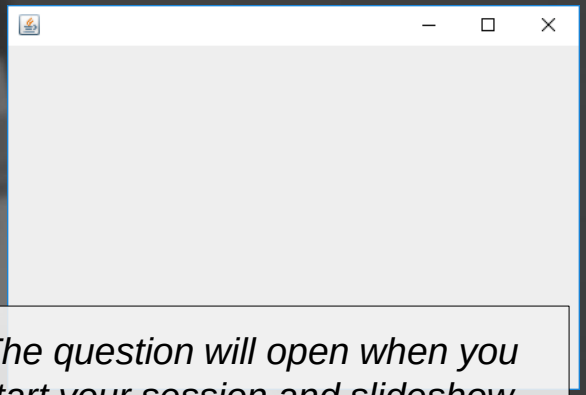
Shakespeak

In Java, there is a common practice in terms of naming code parts. What is this part?: readDistance()



What type of object do you need to create a window (border and title bar) for an application?

A. JApp
B. JFrame
C. JPanel
D. JWindow



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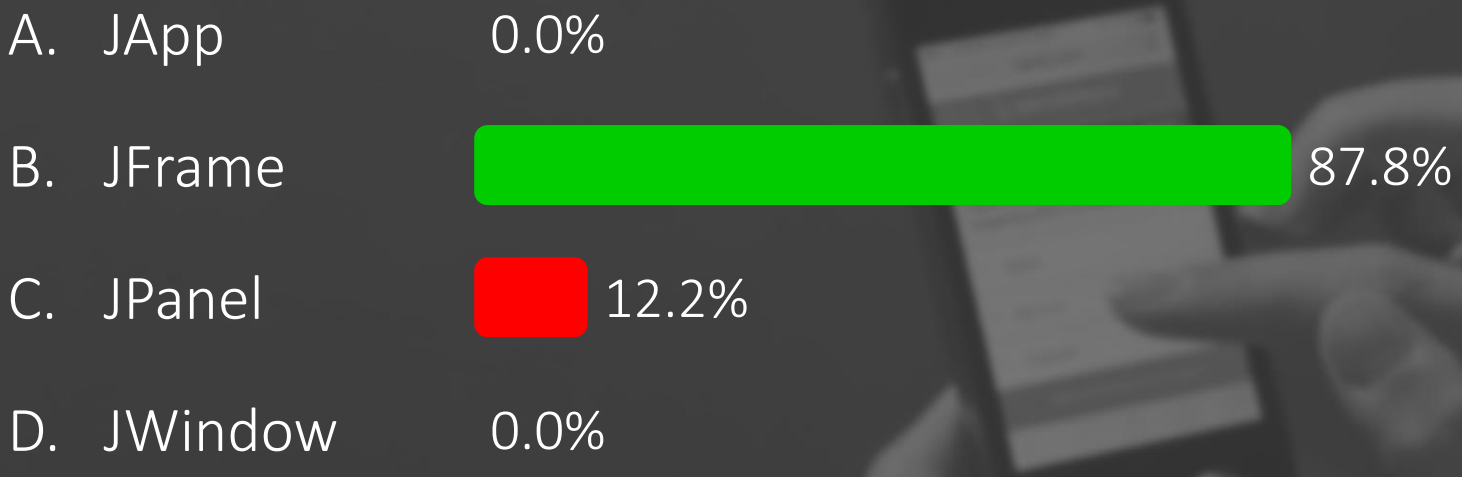
Votes: 41 ● Closed

What type of object do you need to create a window (border and title bar) for an application?



In Java, if you want to display the value of variable `length`, what code should be at the dots?

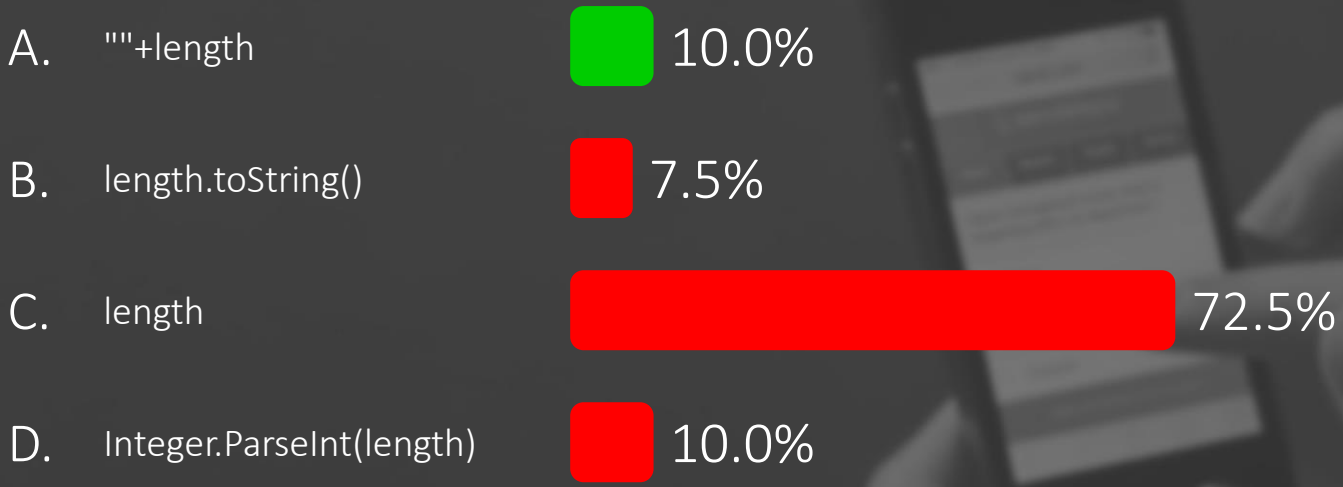
```
int length=180;
g.drawString( ... , 100, 100 );
```

A. `""+length`
B. `length.toString()`
C. `length`
D. `Integer.ParseInt(length)`

The question will open when you start your session and slideshow.

Votes: 40 ● Closed

In Java, if you want to display the value of variable length, what code should be at the dots?




```
int length=180;
g.drawString( ... , 100, 100 );
```

Closed

What are the values of a and b after this code?

```
int a=3, b=2;
a++;
b = b+a;
a = b/a;
```

A. a==1.5 b==6
B. a==1.5 b==5
C. a==1 b==6
D. a==1 b==5

The question will open when you start your session and slideshow.

Votes: 38 Closed

What are the values of a and b after this code?

```
int a=3, b=2;
a++;
b = b+a;
a = b/a;
```

A. a==1.5 b==6 — 39.5%

B. a==1.5 b==5 — 21.1%

C. a==1 b==6 — 21.1%

D. a==1 b==5 — 18.4%

Closed

In Java, what method call can you use to convert the string "10.95" to a double?

A. `Double.parseDouble()`
B. `String.format()`
C. `Integer.parseInt()`
D. `String.parseDouble()`

The question will open when you start your session and slideshow.

Votes: 39 ● Closed

Internet
TXT
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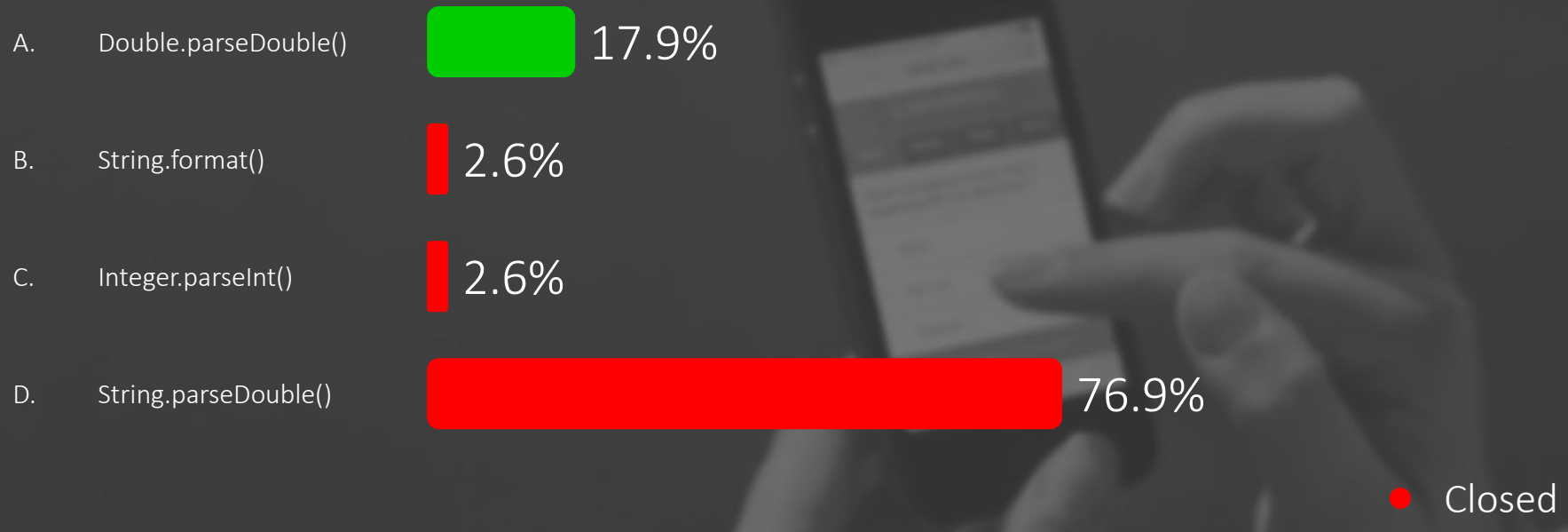
Shakespeak

In Java, what method call can you use to convert the string "10.95" to a double?



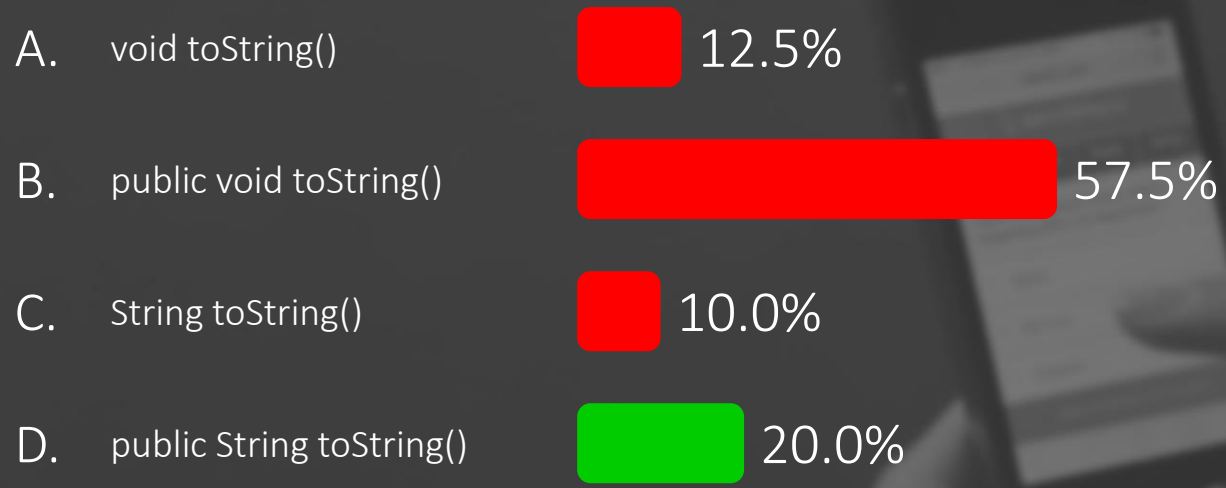
It can be useful for a class to have a method **`toString()`**.
In Java, what should the full header of this method look like?

A. `void toString()`
B. `public void toString()`
C. `String toString()`
D. `public String toString()`

The question will open when you start your session and slideshow.

Votes: 40 ● Closed

It can be useful for a class to have a method toString(). In Java, what should the full header of this method look like?



Write Java code for a class Book with properties title and number of pages as class-variables.

A. `public class Book { String title; int pages; }`

B. `public Book { class } title:String, pages:int`

C. `class Book { title(); pages(); }`

A

```
public class Book {
  String title;
  int pages;
}
```

B

```
public Book { class }
  title:String,
  pages:int
```

C

```
class Book {
  title();
  pages();
}
```

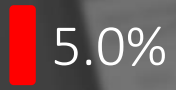
The question will open when you start your session and slideshow.

Votes: 40 ● Closed

Write Java code for a class Book with properties title and number of pages as class-variables.

A. public class Book { String title; int pages; }

B. public Book { class } title:String, pages:int



C. class Book { title(); pages(); }

A

```
public class Book {
  String title;
  int pages;
}
```

B

```
public Book { class }
  title:String,
  pages:int
```

C

```
class Book {
  title();
  pages();
}
```

Closed

In Java, which method for the class Book can be used to set the title with any given value? The value is a parameter of the method.

A. `String setTitle() { title = value; }`

B. `setTitle(String value) { title = "value"; }`

C. `public void setTitle(String s) { title = s; }`

D. `public String setTitle() { title = "value"; }`

The question will open when you start your session and slideshow.

Votes: 41 ● Closed

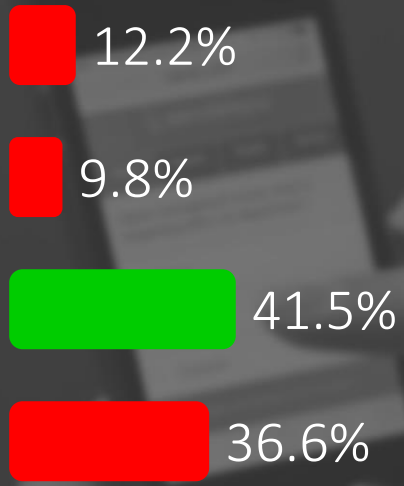
In Java, which method for the class Book can be used to set the title with any given value? The value is a parameter of the method.

A. `String setTitle() { title = value; }`

B. `setTitle(String value) { title = "value";...`

C. `public void setTitle(String s) { title = s; }`

D. `public String setTitle() { title = "value"; }`



Closed

Given Java code is part of a class. What is a correct header for a loop that shows the titles of all books? The code should be at the spot indicated with **//...**

A. while (t<10)
B. for (int t=0; t<books.size(); t++)
C. for (t=0; t<ArrayList.size(); t++)
D. while (int t=0; books.size(); t++)

```
ArrayList<Book> books;

public void showTitles() {
  // Display titles of all books
  //...
  {
      Book b = books.get(t);
      System.out.println(b.getTitle());
  }
}
```

The question will open when you start your session and slideshow.

Votes: 43 ● Closed

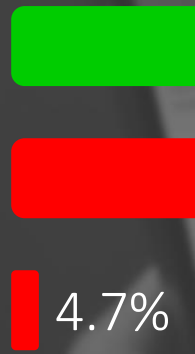
Given Java code is part of a class. What is a correct header for a loop that shows the titles of all books? The code should be at the spot indicated with //...

A. while (t<10) — 0.0%

B. for (int t=0; t<books.size(); t++) — 46.5%

C. for (t=0; t<ArrayList.size(); t++) — 48.8%

D. while (int t=0; books.size(); t++) — 4.7%



```
ArrayList<Book> books;
public void showTitles() {
  // Display titles of all books
  //...
  {
      Book b = books.get(t);
      System.out.println(b.getTitle());
  }
}
```

Closed

What is the value of a and b after running this code?

A. a == 2 and b == 2
B. a == 2 and b == 3
C. a == 3 and b == 2
D. a == 3 and b == 3

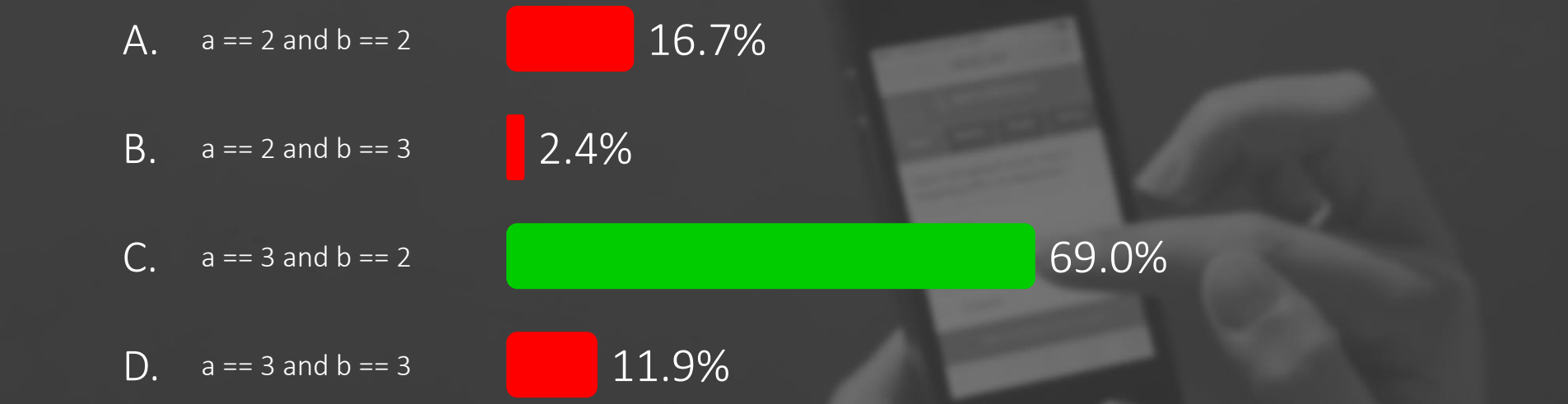
```
int a = 2, b = 3;
if ( a < b ) {
  int t = a;
  a = b;
  b = t;
}
```

The question will open when you start your session and slideshow.

Votes: 42 ● Closed

What is the value of a and b after running this code?

```
int a = 2, b = 3;
if ( a < b ) {
  int t = a;
  a = b;
  b = t;
}
```



Closed

shakespeak

Which function call will turn on the on-board LED of an Arduino?

A. `pinMode(LED_BUILTIN, OUTPUT);`
B. `digitalWrite(LED_BUILTIN, HIGH);`
C. `digitalWrite(LED_BUILTIN, LOW);`
D. `digitalRead(LED_BUILTIN);`

The question will open when you start your session and slideshow.

Votes: 44 ● Closed

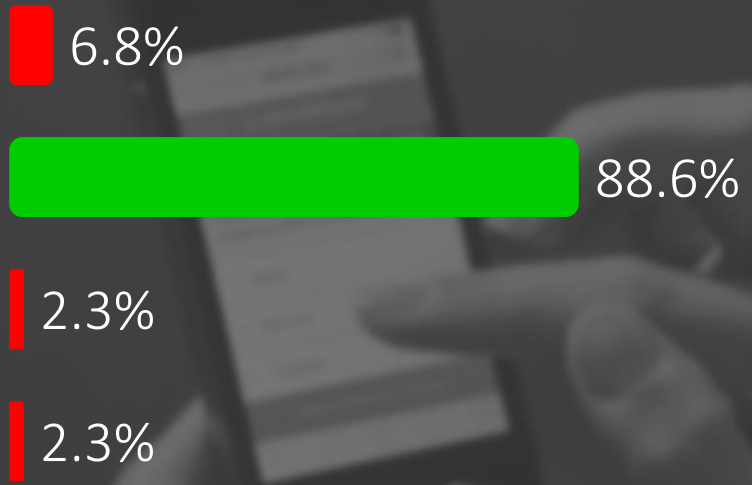
Which function call will turn on the on-board LED of an Arduino?

A. pinMode(LED_BUILTIN, OUTPUT);

B. digitalWrite(LED_BUILTIN, HIGH);

C. digitalWrite(LED_BUILTIN, LOW);

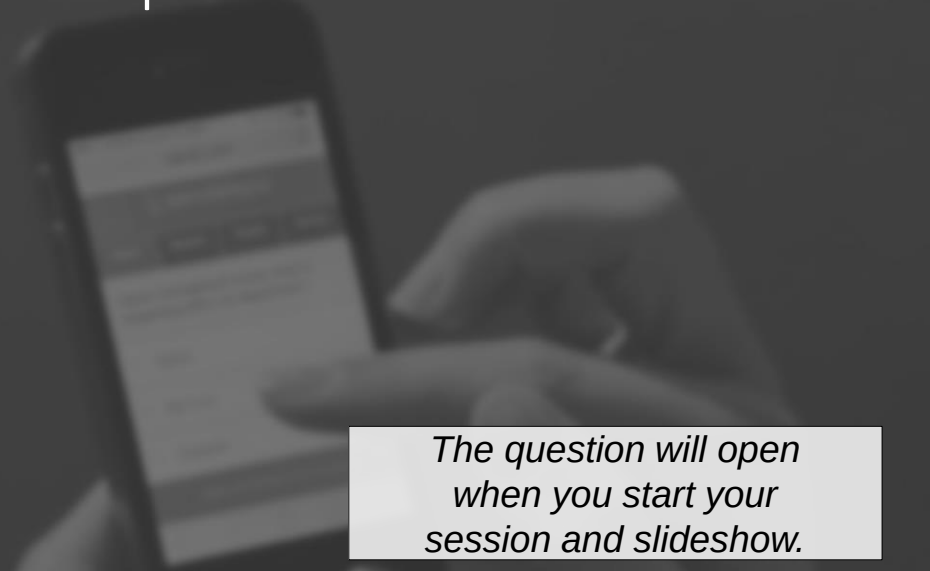
D. digitalRead(LED_BUILTIN);



Closed

Which function is called repetitively over and over again as long as the Arduino has power?

A. power()
B. repeat()
C. loop()
D. setup()



The question will open when you start your session and slideshow.

Votes: 44 ● Closed

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Internet
TXT
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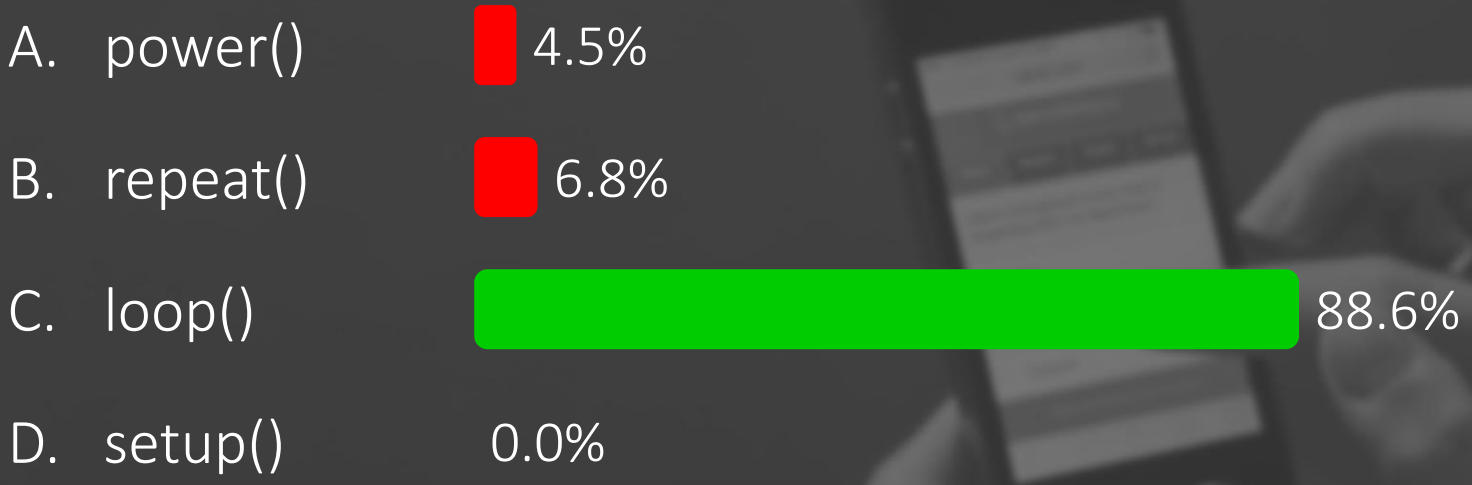
Shakespeak

Which function is called repetitively over and over again as long as the Arduino has power?



What line of code has to be added to the setup() method to make the car drive 100cm?

A. car.drive(100);
B. car->drive(100);
C. Rover::drive(100);
D. car { drive(100) };

```
Rover car;

void setup() {
  // start serial port output
  Serial.begin(115200);

  // initialize robot:
  car.init(&evshield, &sonar, &touch);
}
```

[check Appendix: Explorer.h]

session and slideshow.

Votes: 43 ● Closed

What line of code has to be added to the setup() method to make the car drive 100cm?

```
Rover car;

void setup() {
  // start serial port output
  Serial.begin(115200);

  // initialize robot:
  car.init(&evshield, &sonar, &touch);
}
```

A. car.drive(100); 72.1%

B. car->drive(100); 16.3%

C. Rover::drive(100); 9.3%

D. car { drive(100) }; 2.3%

Closed

shakespeak

Which of the following line(s) of code do you need to have a robot make a point turn (turn around its own axis) with a given angle?

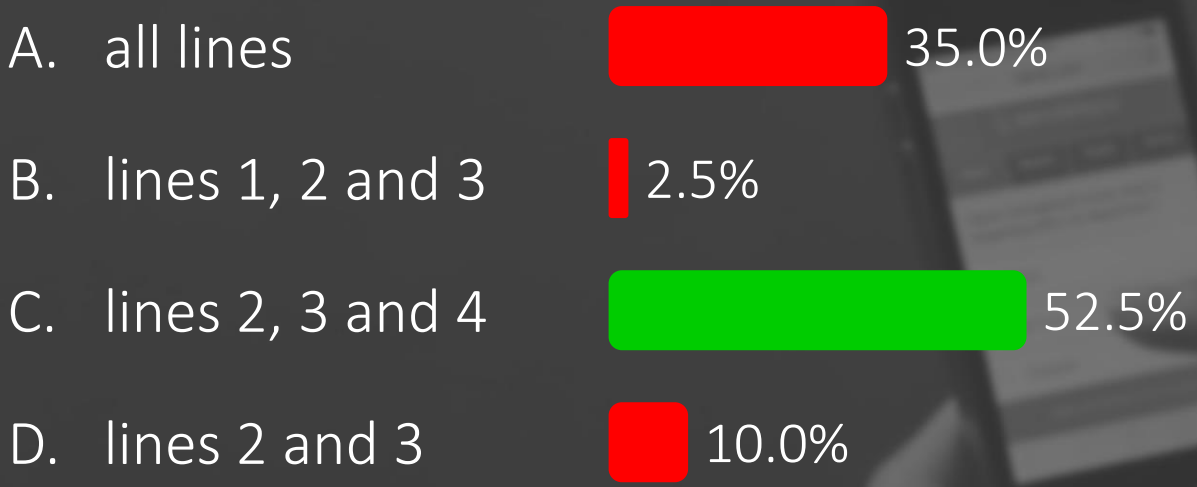
A. all lines
B. lines 1, 2 and 3
C. lines 2, 3 and 4
D. lines 2 and 3

```
1: double circumference = WHEEL_DIAM * PI;

2: unsigned int degrees = abs(angle) * (TRACKWIDTH / WHEEL_DIAM);

3: evshield->bank_a.motorRunDegrees(SH_Motor_1, SH_Direction_Forward,
speed, degrees, SH_Completion_Dont_Wait, SH_Next_Action_Float);

4: evshield->bank_a.motorRunDegrees(SH_Motor_2, SH_Direction_Reverse,
speed, degrees, SH_Completion_Wait_For, SH_Next_Action_Float);
```

The question will open when you start your session and slideshow.

Votes: 40 ● Closed

Which of the following line(s) of code do you need to have a robot make a point turn (turn around its own axis) with a given angle?




```
1: double circumference = WHEEL_DIAM * PI;
2: unsigned int degrees = abs(angle) * (TRACKWIDTH / WHEEL_DIAM);
3: evshield->bank_a.motorRunDegrees(SH_Motor_1, SH_Direction_Forward, speed, degrees, SH_Completion_Dont_Wait, SH_Next_Action_Float);
4: evshield->bank_a.motorRunDegrees(SH_Motor_2, SH_Direction_Reverse, speed, degrees, SH_Completion_Wait_For, SH_Next_Action_Float);
```

Closed

At the first line of the code below, how will variable **d** get the proper value of the distance from the ultrasonic sensor of the car?

A. `car.getDistance();`

B. `car.checkSensors();`

C. `car.sonar->ping_cm();`

D. `car.readDistance();`

```
unsigned int d = ...;
if (!freeWay) {
  Serial.print("d="); Serial.println(d);
  if (d > 10 && d < 400) {
    freeWay = true;
    Serial.println("The wait is over, we can drive!");
  }
}
```

car is an object of class Rover.
See its declaration in Appendix: Rover.h

you start your session and slideshow.

Votes: 41 ● Closed

At the first line of the code below, how will variable d get the proper value of the distance from the ultrasonic sensor of the car?

A. car.getDistance(); 41.5%

B. car.checkSensors(); 12.2%

C. car.sonar->ping_cm(); 29.3%

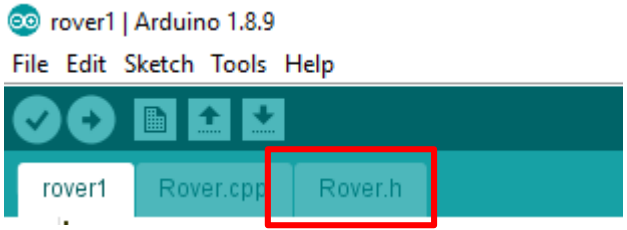
D. car.readDistance(); 17.1%

```
unsigned int d = ...;
if (!freeWay) {
  Serial.print("d="); Serial.println(d);
  if (d > 10 && d < 400) {
    freeWay = true;
    Serial.println("The wait is over, we can drive!");
  }
}
```

Closed

PRACTICE EXAM

APPENDIX




```
#define TRIGGER_PIN  3  // Arduino pin tied to trig. pin on ultrasonic sensor
#define ECHO_PIN     5  // Arduino pin tied to echo pin on ultrasonic sensor
#define MAX_DISTANCE 300 // Maximum distance we want to ping for (in
centimeters). Maximum sensor distance is rated at 400-500cm.

#include <Wire.h>
#include <EVShield.h>
#include <EVs_NXTTouch.h>
#include <NewPing.h>

/**
  @brief This class interfaces with EVShield to create a mobile robot.
  Setup:
    - Two motors to drive, connected to Bank A of the EVShield
    - One motor on which the ultrasonic sensor is mounted: M1 on Bank B
    - Touch sensor on port as specified in the Rover::init() method in
Rover.cpp
*/
```

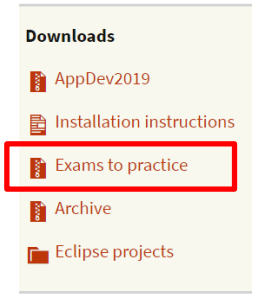
Get Explorer.h from Assignment 4a

```
class Rover {
  // class variables:
private:
  // pointers to objects created in main sketch:
  EVShield * evshield;
  NewPing * sonar;
  EVs_NXTTouch * touch;

public:
  SH_Motor steerMotor = SH_Motor_1; // motor (M1) on Bank B used for steering front
wheels
  SH_Motor sensorMotor = SH_Motor_2; // motor (M2) on Bank B on which the ultrasonic
sensor is mounted

  // speed and driving:
  int start_speed = 15;  // start speed (speed can be any value between 0-100)
  int speed=start_speed;
  boolean dr_forward = false, dr_backward = false; // moving in forward or backward
direction

  // car dimension:
  unsigned int car_rear_track = 145; // car's rear track, the distance between the
centerline of each rear wheel (in millimeters)
  unsigned int car_wheelbase = 185; // car's wheelbase, the distance between the center
of the front wheels and the rear wheels (in millimeters)
  float car_wheel_diam = 4.96; // car's wheel diameter in cm (wheels attached to motors)

  // methods:

  void init(EVShield * s, NewPing * p, EVs_NXTTouch * t);

  // driving related methods:
  void increase_speed();
  void decrease_speed();
  void forward();
  void backward();
  void differentialDrive(SH_Direction dir, int degrees = 0);
  void drive(int distance = 0);
  void stop();
  void steer(int degrees = 12);
  void straight();
  void reverseDirection();

  // sensor related methods:
  void checkSensors();
  unsigned int readDistance(); // read the distance from the ultrasonic sensor
};
```

TODAY: FINALIZE ASSIGNMENT 7

- Morning: help with assignment & check (or… work on project)
- Afternoon: help with project, and if you want: feedback on prototype regarding Application Development aspects

downloads @ vanslooten.com/appdev



Help with project is available next week also (@ my office)