Computer Programming Fundamentals

CS 152
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TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/

USE PIAZZA FOR QUESTIONS DURING LECTURE

DUE TUESDAY: ASSIGNMENT 2

- Due Tuesday 9/6 by 9:30am
- Use the Screen.java code from class
- Submit via UNM Learn

EXAMPLES

questions?

OPEN UP CODE FROM MONDAY

REPLIT

- Rename your ScreenExample.java file Main.java
- Rename your class Main.java
- Replit will only run a program if it is called Main.java

Files

- Main.java
- Screen.java

Main.java ×

```java
10
11   public class Main {
12       //Create a screen/window to draw in
13       static Screen screen= new Screen();
14
15       //Main just paints the screen over and over forever
16       public static void main(String[] args) {
17           while (true) {
18               paint();
19           }
20       }
21
22       //The paint() method is where all the interesting stuff happens
23       public static void paint() {
24           //clear the screen
25           screen.clearScreen();
26           Graphics g = screen.getGraphics();
27
28           //Do all drawing here
29           g.setColor(Color.BLACK);
30           g.drawRect(150,150,50,50);
31
32           //update the screen with the drawing that you made
33           screen.update(g);
34       }
35   }
```
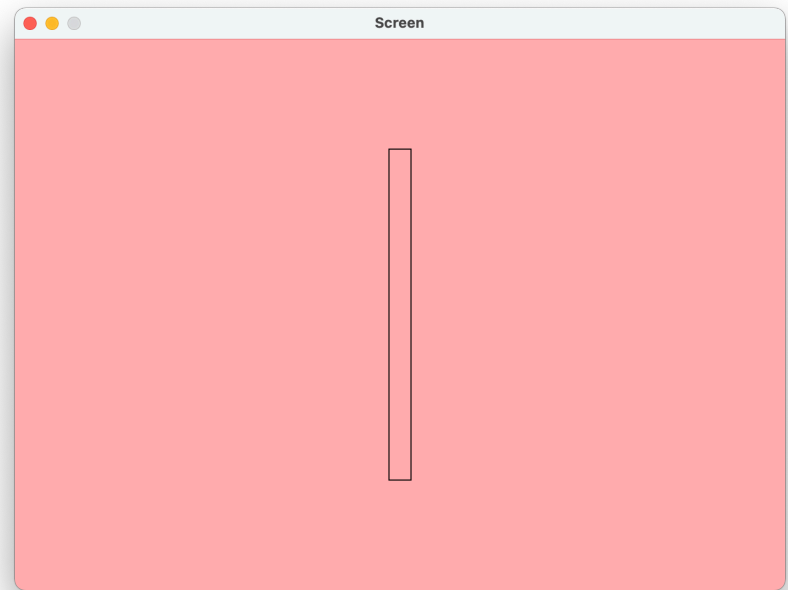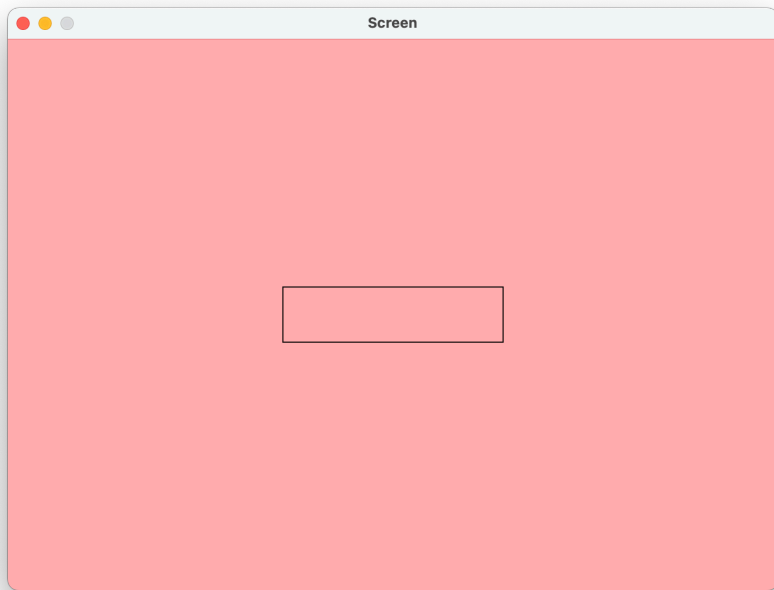
CODE FROM MONDAY

```java
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Graphics g = screen.getGraphics();
    screen.setBackground(Color.PINK);

    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

CENTERED RECTANGLES

questions?

VARIABLES

variable's type

```
int rectWidth = 200;
```

int = integer
a whole number

variable's name

```
int rectWidth = 200;
```

variable's value

```
int rectWidth = 200;
```

semicolon

```
int rectWidth = 200;
```

```
int rectWidth;
rectWidth = 200;
```

can also define a variable on one line
and assign a value to it later

PROGRAM

```java
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Graphics g = screen.getGraphics();
    screen.setBackground(Color.PINK);

    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);

    //update the screen with the drawing that you made
    screen.update(g);
}
```
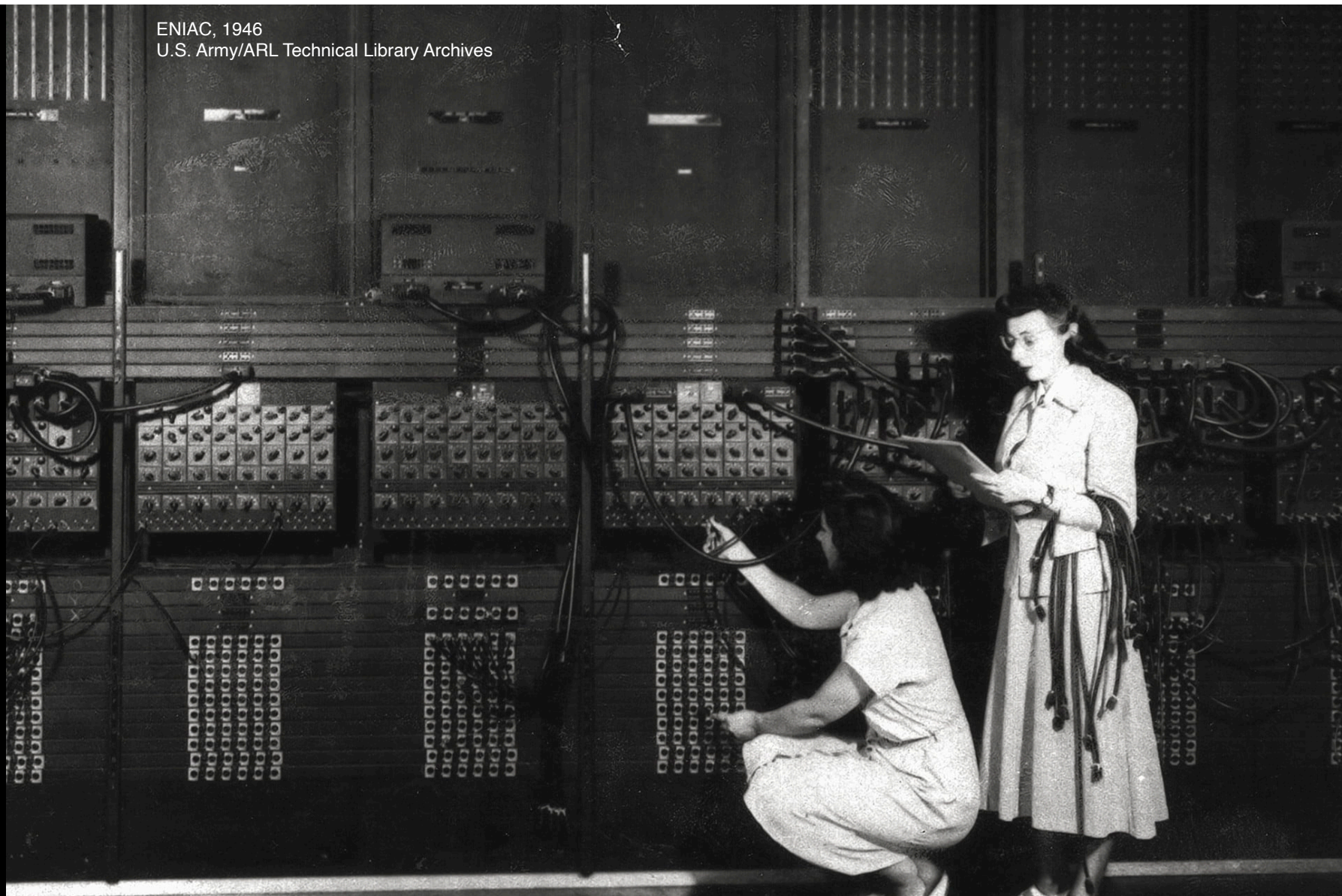
TYPE

variable's type

```
int rectWidth = 200;
```

ENIAC, 1946
U.S. Army/ARL Technical Library Archives

WHAT IS THIS?

0   0   1   0   1   1   0   1

inside the computer everything looks the same in bits

WHAT IS TYPE?

tells the computer how much memory
a variable takes up +
what it can do with the variable

BASIC NUMBER TYPES IN JAVA

TYPE	# BITS	minimum value	maximum value	example
byte	8	-128	127	53
int	32	-2,147,483,648	2,147,483,647	3079
float	32	$\sim -3.4 \times 10^{38}$ with 7 significant digits	$\sim 3.4 \times 10^{38}$ with 7 significant digits	4.589

WHAT HAPPENS?

```java
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Graphics g = screen.getGraphics();
    screen.setBackground(Color.PINK);

    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

WHAT HAPPENS?

```java
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Graphics g = screen.getGraphics();
    screen.setBackground(Color.PINK);

    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200.5;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

TYPE COMPILE ERROR

/Users/LAB_1/websites/CS152_Fall2021/javaCode/ScreenExample/src/ScreenExample.java:33:25
java: incompatible types: possible lossy conversion from double to int

MORE NUMBER TYPES IN JAVA

TYPE	# BITS	minimum value	maximum value	example
short	16	-32,768	32,767	134
long	64	$\sim -9.2 \times 10^{18}$	$\sim 9.2 \times 10^{18}$	30,790
double	64	$\sim -1.7 \times 10^{308}$ with 15 significant digits	$\sim 1.7 \times 10^{308}$ with 15 significant digits	10,789.998

OTHER "PRIMITIVE" TYPES IN JAVA

TYPE	# BITS	# possible values	examples
char	16	65,536	'A' 'c' '?'
boolean	1	2	true false

PRIMITIVE TYPE

cannot be broken down into a simpler type

MORE COMPLEX TYPES ARE COLLECTIONS OF THINGS

TYPE	collection of	example
String	chars	`String s = "hello";`
arrays	many items of a single type	`int[] n = {1,2,3};` `char[] c = {'a','b', 'c'};`
Color	numbers that define a color	`Color c = new Color(50,0,100);`

WHAT OTHER COMPLEX TYPES ARE IN OUR PROGRAM?

MORE COMPLEX TYPES ARE COLLECTIONS OF THINGS

TYPE	collection of	example
Screen	screen related stuff	`Screen screen = …`
Graphics	graphics related stuff	`Graphics g = …`

questions?

JAVA IS "STRONGLY TYPED"

- When you define a variable you have to specify its type.
- Other languages are different (ie: Python)

```java
int rectWidth = 200;
```

A LITTLE BIT OF TEXT

STRING TYPE

```java
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Graphics g = screen.getGraphics();
    screen.setBackground(Color.PINK);

    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    String name = "Leah";
    g.drawString(name,100,100);


    //update the screen with the drawing that you made
    screen.update(g);
}
```
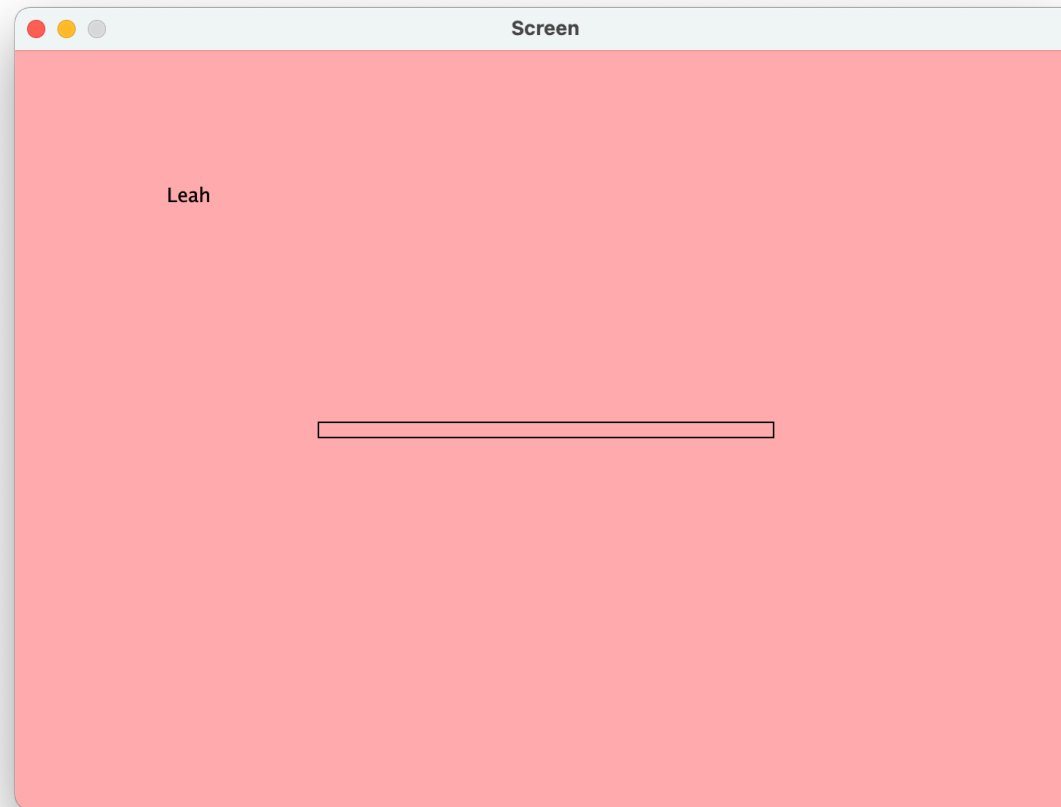
# STRING TYPE

A LITTLE BIT OF COLOR

COLOR TYPE

```java
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Color backgroundColor = new Color(196, 154, 6);
    screen.setBackground(backgroundColor);
    Graphics g = screen.getGraphics();


    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawRect(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    String name = "Leah";
    g.drawString(name,100,100);


    //update the screen with the drawing that you made
    screen.update(g);
}
```
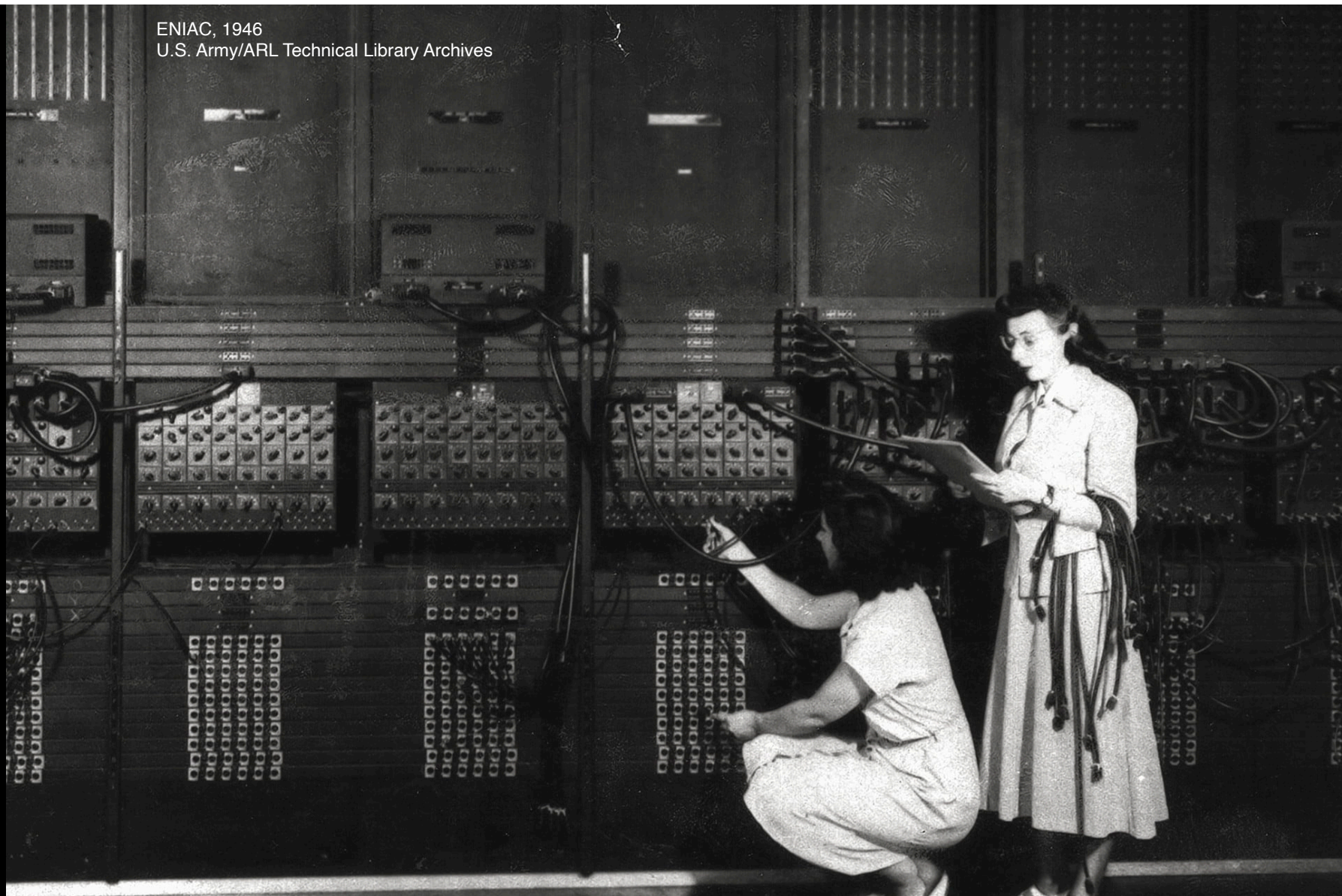
COLOR TYPE

Leah
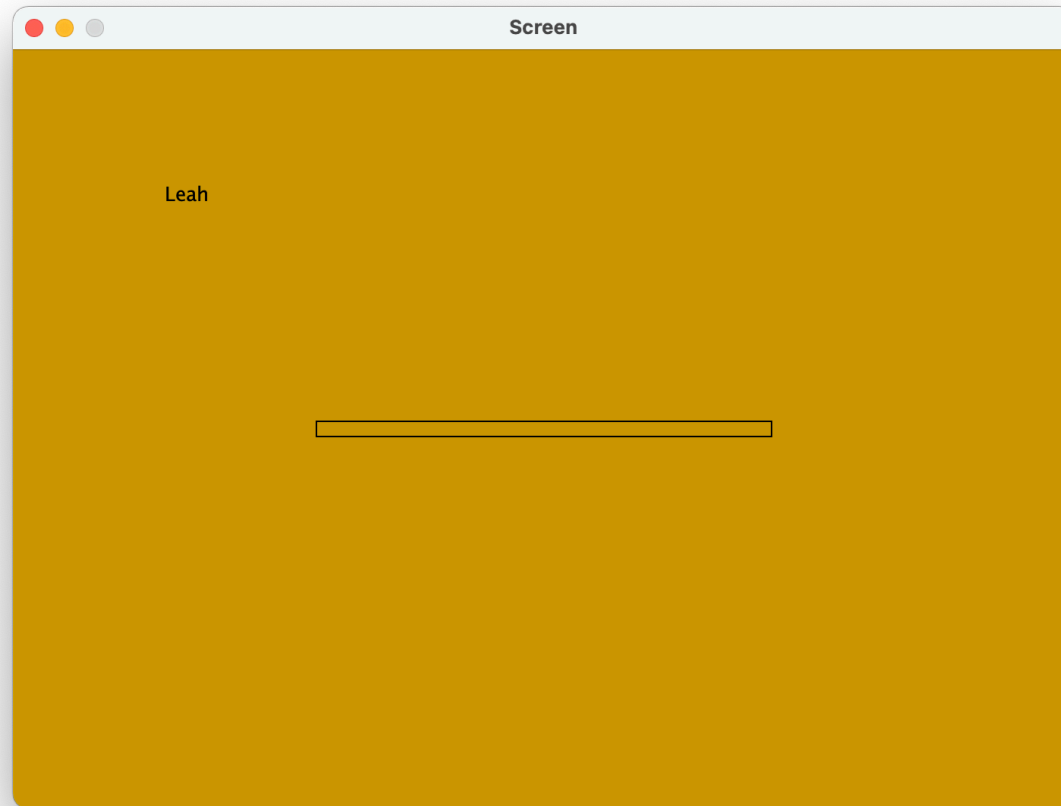
TYPE & MEMORY

ENIAC, 1946
U.S. Army/ARL Technical Library Archives

BITS AND BYTES

TYPE: BYTE

0	0	0	0	0	0	0	0	**0**
0	0	0	0	0	0	0	1	**1**
0	0	0	0	0	0	1	0	**2**
0	0	0	0	0	0	1	1	**3**

TYPE: BYTE

0	0	0	0	0	1	0	0	**4**
0	0	0	0	0	1	0	1	**5**
0	0	0	0	0	1	1	0	**6**
0	0	0	0	0	1	1	1	**7**

TYPE: BYTE

0	0	0	0	1	0	0	0	**8**
0	0	0	1	0	0	0	0	**16**
0	0	1	0	0	0	0	0	**32**
0	1	0	0	0	0	0	0	**64**

TYPE: BYTE

1	0	0	0	0	0	0	0	**128**
0	1	1	1	1	1	1	1	**?**
1	1	1	1	1	1	1	1	**?**

TYPE: BYTE

0	0	0	0	0	0	0	1	**128**
0	1	1	1	1	1	1	1	**127**
1	1	1	1	1	1	1	1	**255**

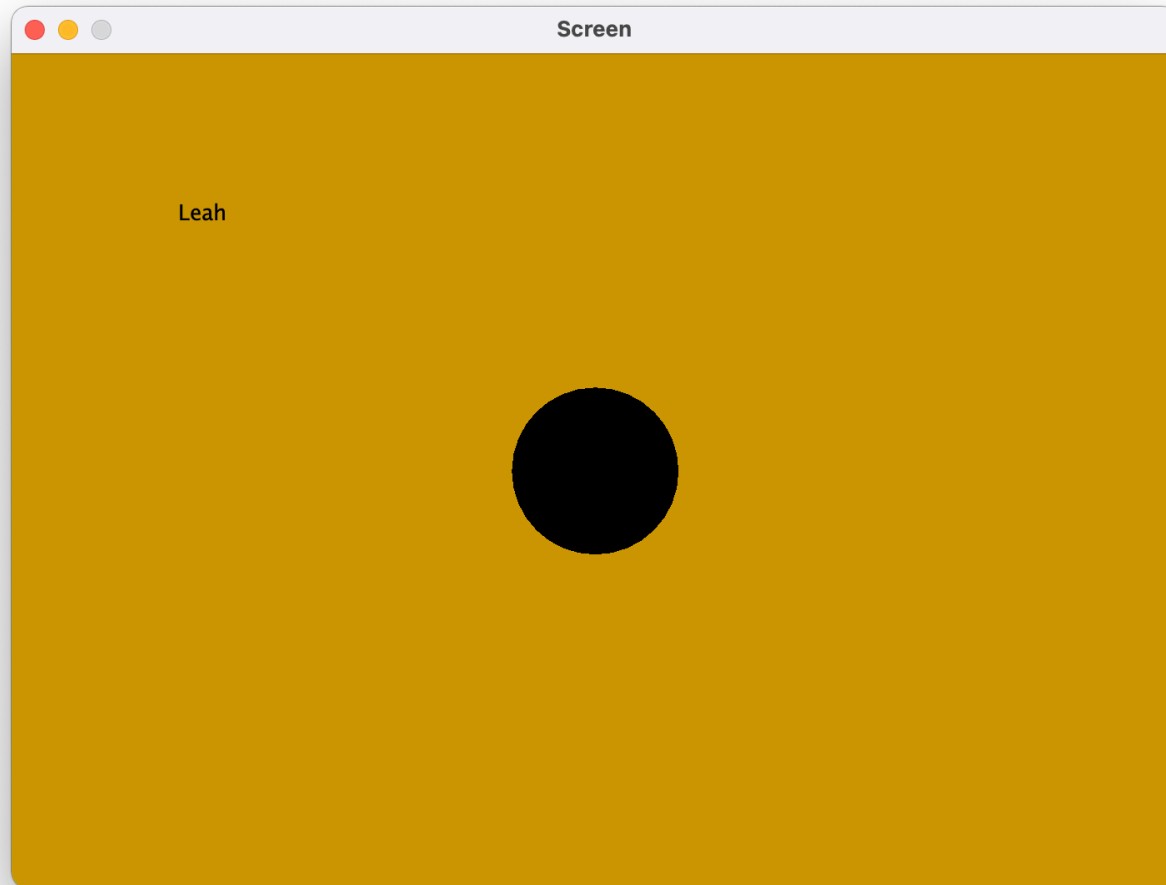questions?

MORE DRAWING FEATURES

CIRCLES & OVALS

```java
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Color backgroundColor = new Color(196, 154, 6);
    screen.setBackground(backgroundColor);
    Graphics g = screen.getGraphics();


    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawOval(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    String name = "Leah";
    g.drawString(name,100,100);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

CIRCLES & OVALS

```java
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Color backgroundColor = new Color(196, 154, 6);
    screen.setBackground(backgroundColor);
    Graphics g = screen.getGraphics();


    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 100;
    int rectHeight = 100;
    g.fillOval(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);


    String name = "Leah";
    g.drawString(name,100,100);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

CIRCLES & OVALS

FONT TYPE

```
//The paint() method is where all the interesting stuff happens
public static void paint() {
    //clear the screen
    screen.clearScreen();
    Color backgroundColor = new Color(196, 154, 6);
    screen.setBackground(backgroundColor);
    Graphics g = screen.getGraphics();


    //Do all drawing here
    g.setColor(Color.BLACK);
    int rectWidth = 200;
    int rectHeight = 50;
    g.drawOval(screen.width/2-rectWidth/2, screen.height/2-rectHeight/2, rectWidth, rectHeight);

    Font helvetica = new Font("Helvetica", Font.BOLD, 40);
    g.setFont(helvetica);
    String name = "Leah";
    g.drawString(name,100,100);


    //update the screen with the drawing that you made
    screen.update(g);
}
```

FONT TYPE

```
Font helvetica = new Font("Helvetica", Font.BOLD, 40);
```

- Font must be installed on your computer
- Name must be exact
- Open up Microsoft Word to see a list of fonts →

All Fonts
Abadi MT
Academy Engraved LET
Adobe Arabic
Adobe Caslon Pro
Adobe Devanagari
Adobe Garamond Pro
Adobe Gurmukhi
Adobe Hebrew
Adobe Naskh
Al Bayan
Al Tarikh
American Typewriter
Andale Mono
Angsana New
Apple Braille
Apple Chancery
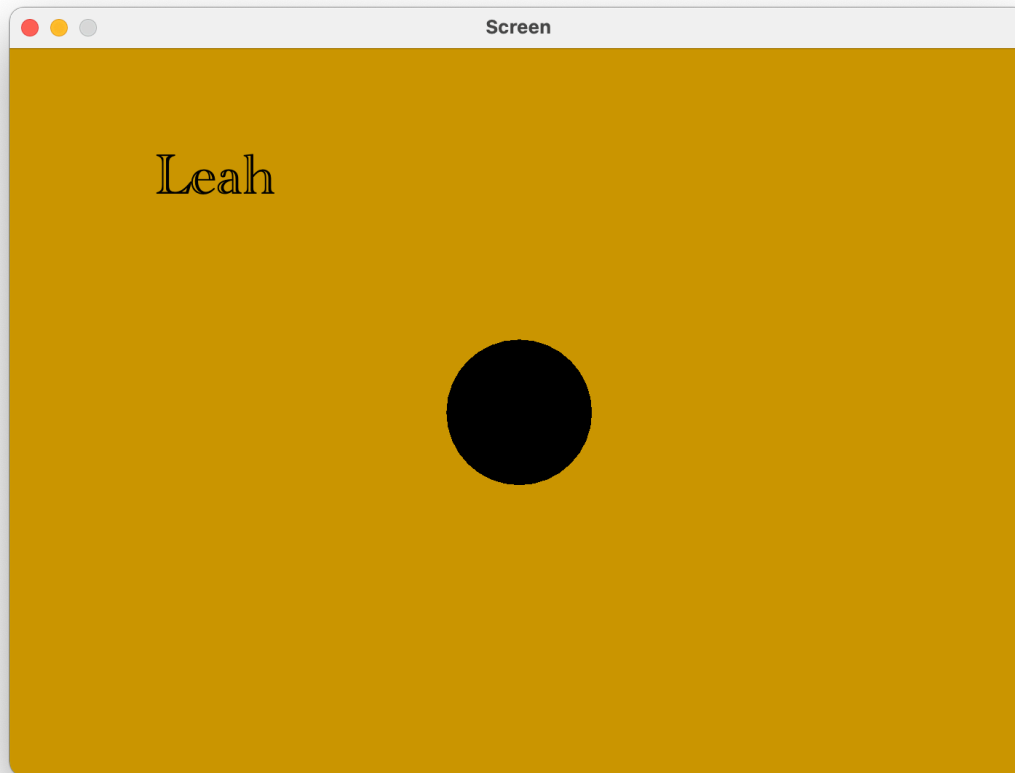Apple Color Emoji
Apple Symbols
Arial
Arial Hebrew
Arial Hebrew Scholar
Arial Rounded MT
Arial Unicode MS

FONT TYPE


```
Font academy = new Font("Academy Engraved LET", Font.BOLD, 40);
g.setFont(academy);
```

All Fonts
Abadi MT
Academy Engraved LET
Adobe Arabic
Adobe Caslon Pro
Adobe Devanagari
Adobe Garamond Pro
Adobe Gurmukhi
Adobe Hebrew
Adobe Naskh
Al Bayan
Al Tarikh
American Typewriter
Andale Mono
Angsana New
Apple Braille
Apple Chancery
Apple Color Emoji
Apple Symbols
Arial
Arial Hebrew
Arial Hebrew Scholar
Arial Rounded MT
Arial Unicode MS

DUE TUESDAY: ASSIGNMENT 2

- Due Tuesday 9/6 by 9:30am
- Use the Screen.java code from class
- Submit via UNM Learn

Thank you!

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