

# Hello, World!

An introduction to programming

# By the end of this course, you will be able to:

- Think like a programmer
- Understand fundamental concepts every programmer should know
- Write simple programs in code
- Know where to go to continue learning

5CS0



- “The new form of literacy is coding”
- Marc Goodman, Cybersecurity Expert

# What is Computer Science?

- Mathematics
- Logic
- Engineering
- Philosophy

Q: What are computers?

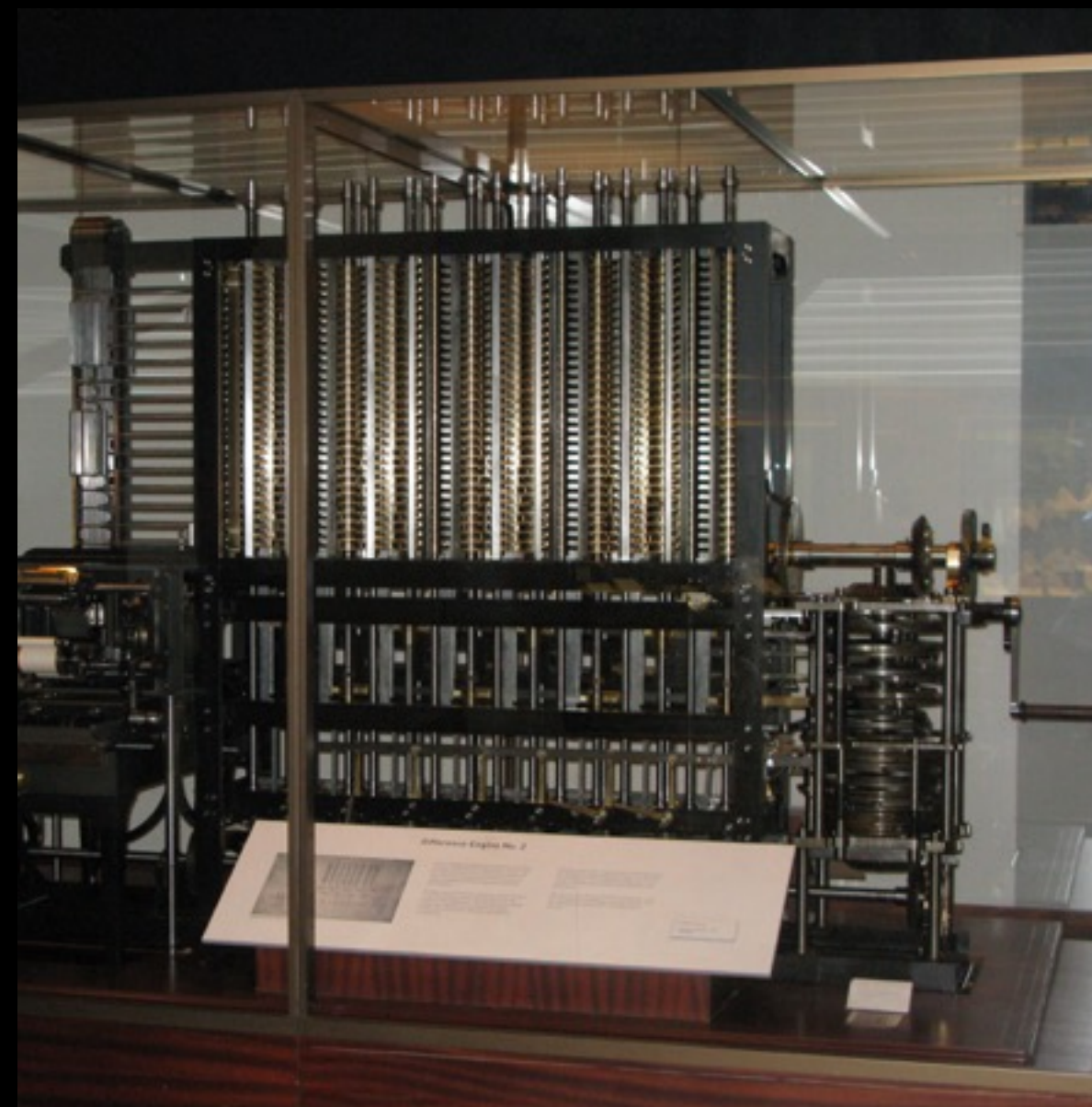
A: Really dumb machines that are perfectly happy doing the same thing over, and over, and over, and...

COMMON LOGARITHMS  $\log_{10} x$

$x$	0	1	2	3	4	5	6	7	8	9	$\Delta_m$	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212		0254	0334	0374	42	4	8	13	17	21	25	29	34	38
11	0414	0453	0492	0531	0569	0607		0645	0682	0719	40	4	8	12	16	20	24	28	31	35
12	0792	0828	0864	0899	0934	0969		1004	1038	1072	37	4	7	11	15	19	23	26	30	33
13	1139	1173	1206	1239	1271	1303		1335	1367	1399	35	4	7	11	14	18	21	25	28	32
14	1461	1492	1523	1553	1584	1614		1644	1673	1703	34	3	7	10	14	17	20	24	27	31
15	1761	1790	1818	1847	1875	1903		1931	1959	1987	33	3	7	10	13	16	19	23	26	30
16	2041	2068	2095	2122	2148	2175		2201	2227	2253	32	3	6	10	13	16	19	22	26	29
17	2304	2330	2355	2380	2405	2430		2455	2480	2504	30	3	6	9	12	15	18	21	24	27
18	2553	2577	2601	2625	2648	2672		2695	2718	2742	28	3	6	8	11	14	17	20	23	25
19	2788	2810	2833	2856	2878	2900		2923	2945	2967	26	3	5	8	10	13	16	18	21	23
20	3080	3092	3094	3095	3096	3118		3139	3160	3181	25	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324		3345	3365	3385	24	2	4	6	8	10	12	14	16	18
22	3426	3446	3466	3483	3502	3522		3541	3560	3579	23	2	4	6	8	10	11	13	15	17
23	3647	3666	3685	3694	3692	3711		3729	3747	3766	22	2	4	5	7	9	11	13	14	16
24	3802	3820	3838	3856	3874	3892		3909	3927	3945	21	2	4	5	7	9	11	13	14	16
25	3979	3997	4014	4031	4048	4065		4082	4099	4116	20	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232		4249	4265	4281	19	2	3	5	6	8	10	11	13	14
27	4314	4330	4346	4362	4378	4393		4409	4425	4440	18	2	3	5	6	8	10	11	13	14
28	4472	4487	4502	4518	4533	4548		4564	4579	4594	17	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698		4713	4728	4742	16	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843		4857	4871	4886	15	1	3	4	6	7	8	10	11	13
31	4914	4928	4942	4955	4969	4983		4997	5011	5024	14	1	3	4	6	7	8	10	11	13
32	5051	5065	5079	5092	5105	5119		5132	5145	5159	13	1	3	4	5	7	8	9	10	12
33	5185	5198	5211	5224	5237	5250		5263	5276	5289	12	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378		5391	5403	5416	11	1	3	4	5	6	8	9	10	12
35	5441	5453	5465	5478	5490	5502		5514	5527	5539	10	1	3	4	5	6	7	8	10	11
36	5563	5575	5587	5599	5611	5623		5635	5647	5658	9	1	3	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740		5752	5763	5775	8	1	3	4	5	6	7	8	10	11
38	5798	5809	5821	5832	5843	5855		5866	5877	5888	7	1	3	4	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966		5977	5988	5999	6	1	3	4	5	6	7	8	9	10
40	6021	6031	6042	6053	6064	6075		6085	6096	6107	5	1	3	4	5	6	7	8	9	10
41	6128	6138	6149	6160	6170	6180		6191	6201	6212	4	1	3	4	5	6	7	8	9	10
42	6222	6232	6243	6253	6263	6274		6284	6294	6304	3	1	3	4	5	6	7	8	9	10
43	6335	6345	6355	6365	6375	6385		6395	6405	6415	2	1	3	4	5	6	7	8	9	10
44	6435	6444	6454	6464	6474	6484		6493	6503	6513	1	1	3	4	5	6	7	8	9	10
45	6532	6542	6551	6561	6571	6580		6590	6599	6609	0	1	3	4	5	6	7	8	9	10
46	6628	6637	6646	6656	6665	6675		6684	6693	6702	9	1	3	4	5	6	7	8	9	10
47	6721	6730	6739	6749	6758	6767		6776	6785	6794	8	1	3	4	5	6	7	8	9	10
48	6812	6821	6830	6839	6848	6857		6866	6875	6884	7	1	3	4	5	6	7	8	9	10
49	6902	6911	6920	6928	6937	6946		6955	6964	6972	6	1	3	4	5	6	7	8	9	10

No.  $\log$   $\ln x = \log_e x = (1/M) \log_{10} x$   $(1/M) = 2.30259$   $\log$   
 $x = 2.71828$   $0.43429$   $\log x = \log_{10} x = M \log_e x$   $M = 0.43429$   $1.63778$

$p$   $1$   $2$   $3$   $4$   $5$   $6$   $7$   $8$   $9$   $10$   
 $\log e^p$   $0.4343$   $0.8686$   $1.3029$   $1.7372$   $2.1715$   $2.6058$   $3.0401$   $3.4744$   $3.9087$   $4.3429$   
 $\log e^{-p}$   $1.9657$   $1.1314$   $0.6971$   $0.2628$   $-0.1715$   $-0.6058$   $-1.0401$   $-1.4744$   $-1.9087$   $-2.3429$



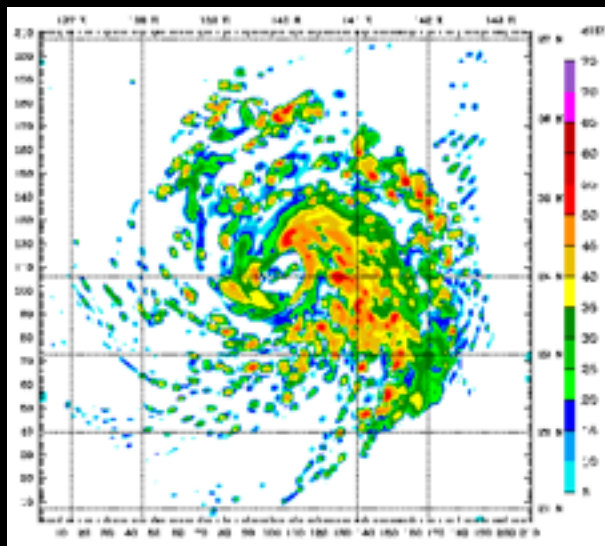
The Difference Engine No. 2  
Charles Babbage, 1847

Log Tables



# In repetition is power

## Some applications



Weather



Music



Commerce



Medicine

# ...and art

```
void loop() {  
  for (int i = 0; i < PIXELS; i++) {  
    strip.setPixelColor(i, BLUE);  
    strip.show();  
    delay(10);  
  }  
  delay(500);  
  for (int i = 0; i < PIXELS; i++) {  
    strip.setPixelColor(i, WHITE);  
    strip.show();  
    delay(10);  
  }  
  delay(500);  
}
```

An everyday example

# How non-programmers interact with computers



# How programmers interact with computers: Code!

```
@RequestMapping(value = "/register", method = RequestMethod.POST)
    public String register(String userName, String password, String
confirmPassword, Model model) {

        User existingUser = userDao.findByUserName(userName);

        if (!password.equals(confirmPassword)) {
            return this.displayError("Passwords do not match. Try again.",
model);
        } else if (existingUser != null) {
            return this.displayError(
                "The username " + userName + " already exists in the
system. Please select a different username", model);
        }

        User newUser = new User(userName, password);
        userDao.save(newUser);
        return "index";
    }
```

But! But!

Computers don't think in code.

They think in **binary**.

So, what is binary?

# Some examples of “Hello, World!”

```
#include <iostream>
public class Hello {
    public static void main(String [] args) {
        System.out.println("Hello World");
    }
}

std::cout << "Hello, World.";
}
```

computer program:

*A set of instructions in a given programming language*



# Characteristics of computer programs

- Execute one instruction at a time
- Allow reuse of subsets of instructions
- Can make decisions
- Can store data in “buckets” for use later, and can use the values in those buckets without caring about the specific value
- Can be made up of many algorithms

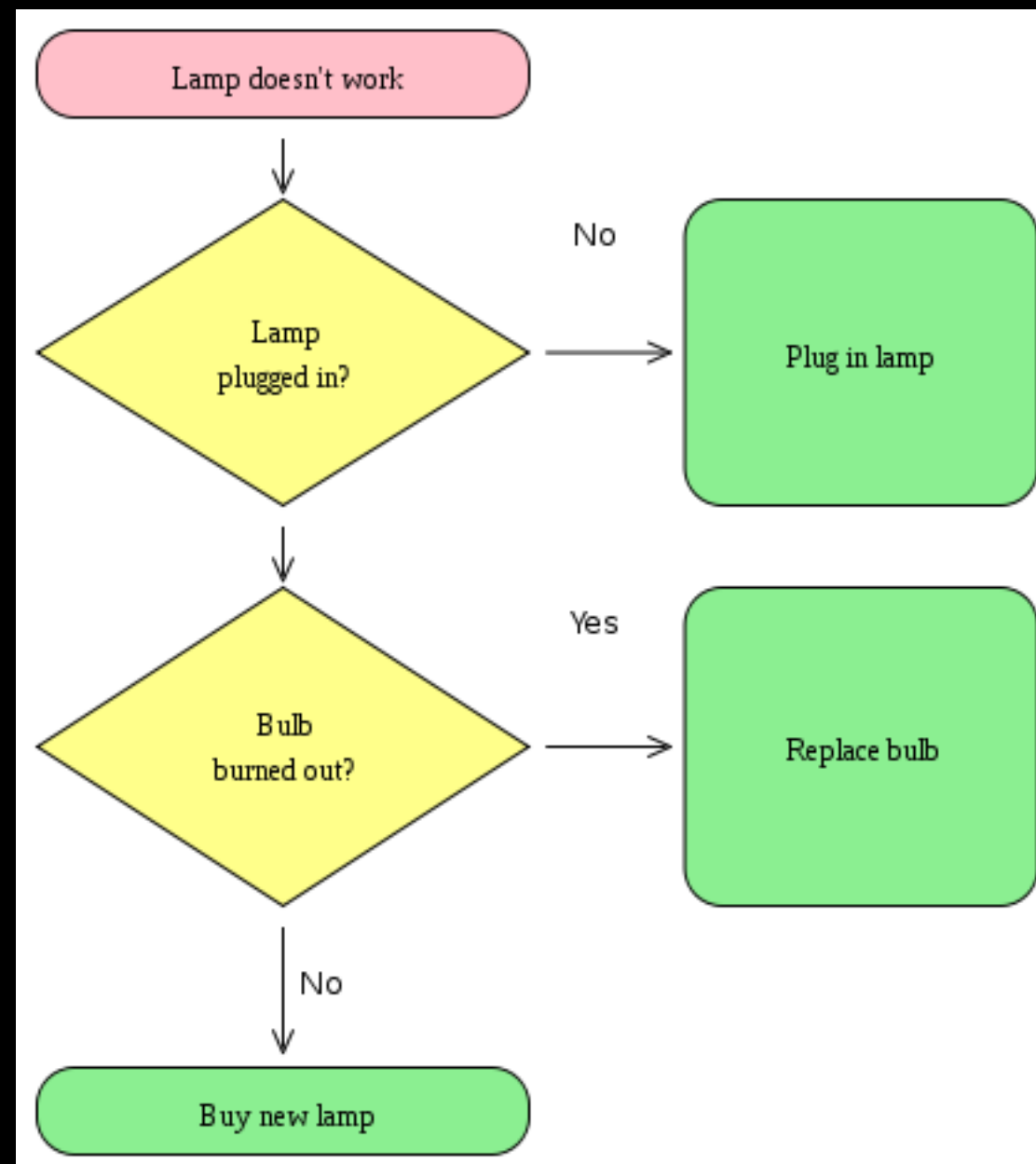
# Peanut Butter Sandwiches!



# Computers are very explicit

The children made delicious snacks.





# Pseudocode

Instructions written out one after the other, like code, employing basic constructs like repetition (i.e. looping) and decision making (i.e. conditionals)

# Conditionals

```
IF STUDENT AT LAUNCHCODE  
  LEARN()  
END IF
```

Has the generic form:

```
IF CONDITION  
  // DO SOMETHING  
END IF
```

# Loops

```
FOR 1..N LOOP  
  PRINT '#'  
END LOOP
```

“for loop”

```
i = 0  
WHILE i < N  
  PRINT '#'  
  i = i + 1  
END WHILE
```

“while loop”

# Exercise:

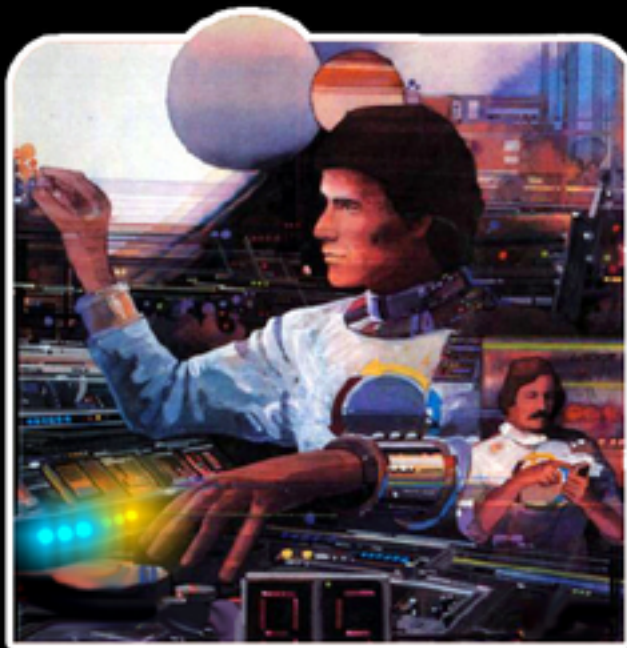
Write a short program in pseudocode that prints out all of the numbers between 1 and 100 that are multiples of 7



# What is code?

<https://vimeo.com/130987431>

# THE TWO STATES OF EVERY PROGRAMMER



**I AM A GOD.**



**I HAVE NO IDEA  
WHAT I'M DOING.**

# Homework

Write a program in pseudocode that gives change for a \$20 bill:

- Assume you are given  $x$  dollars (i.e. you can use a variable  $x$  that represents this amount)
- Calculate the number of each of the following currencies that should be returned: \$10 bill, \$5 bill, \$1 bill, quarter, dime, nickel, penny
- Give back as few bills and coins as possible