CS 103000
Prof. Madeline Blount

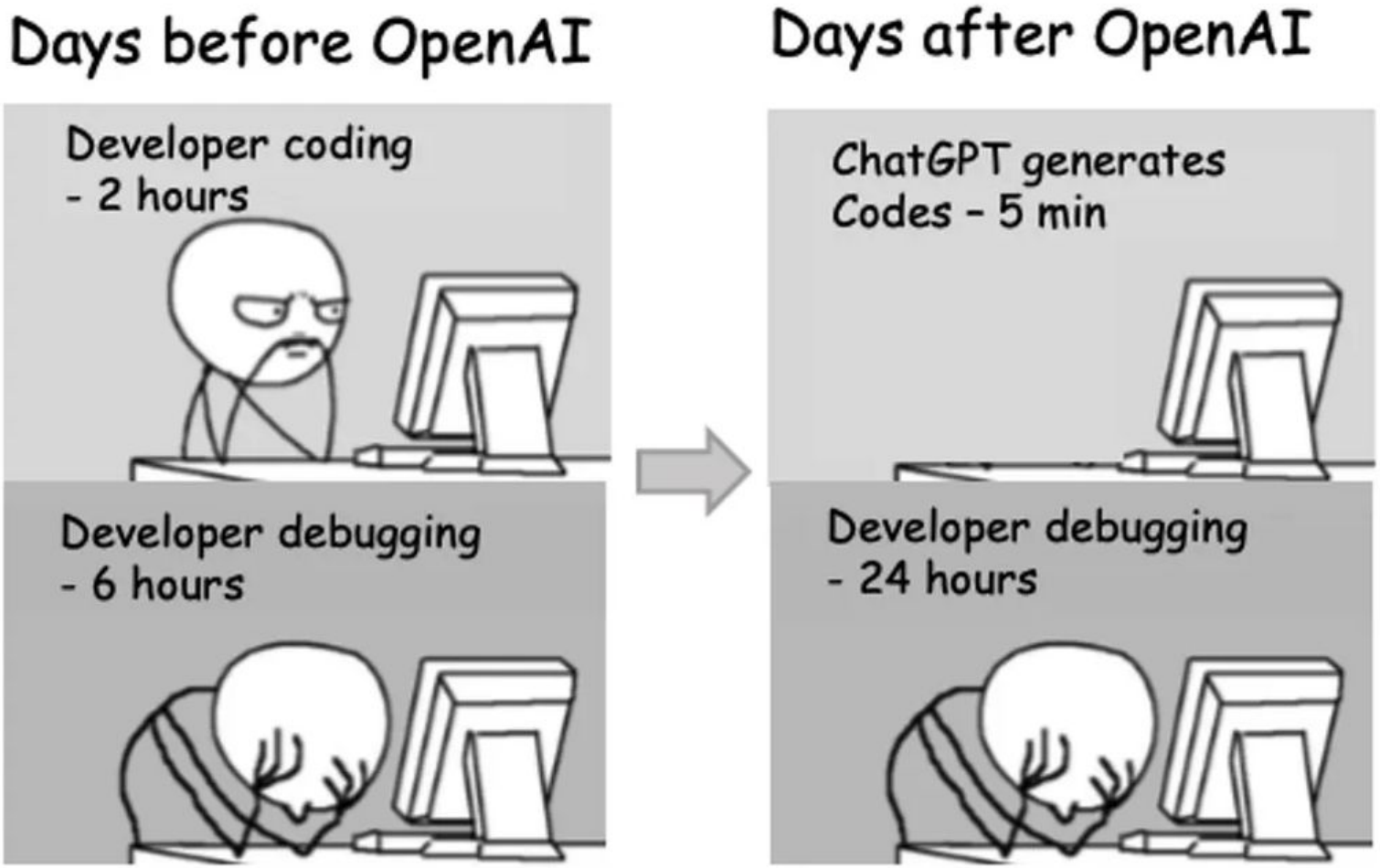
Week 7:
VECTORS (cont.)

Dall-E 2: cats learning C++ in the forest on '90's technology

https://airtable.com/appNisQAaK2SV4aoi/shrAmHeUXat5oyBaZ

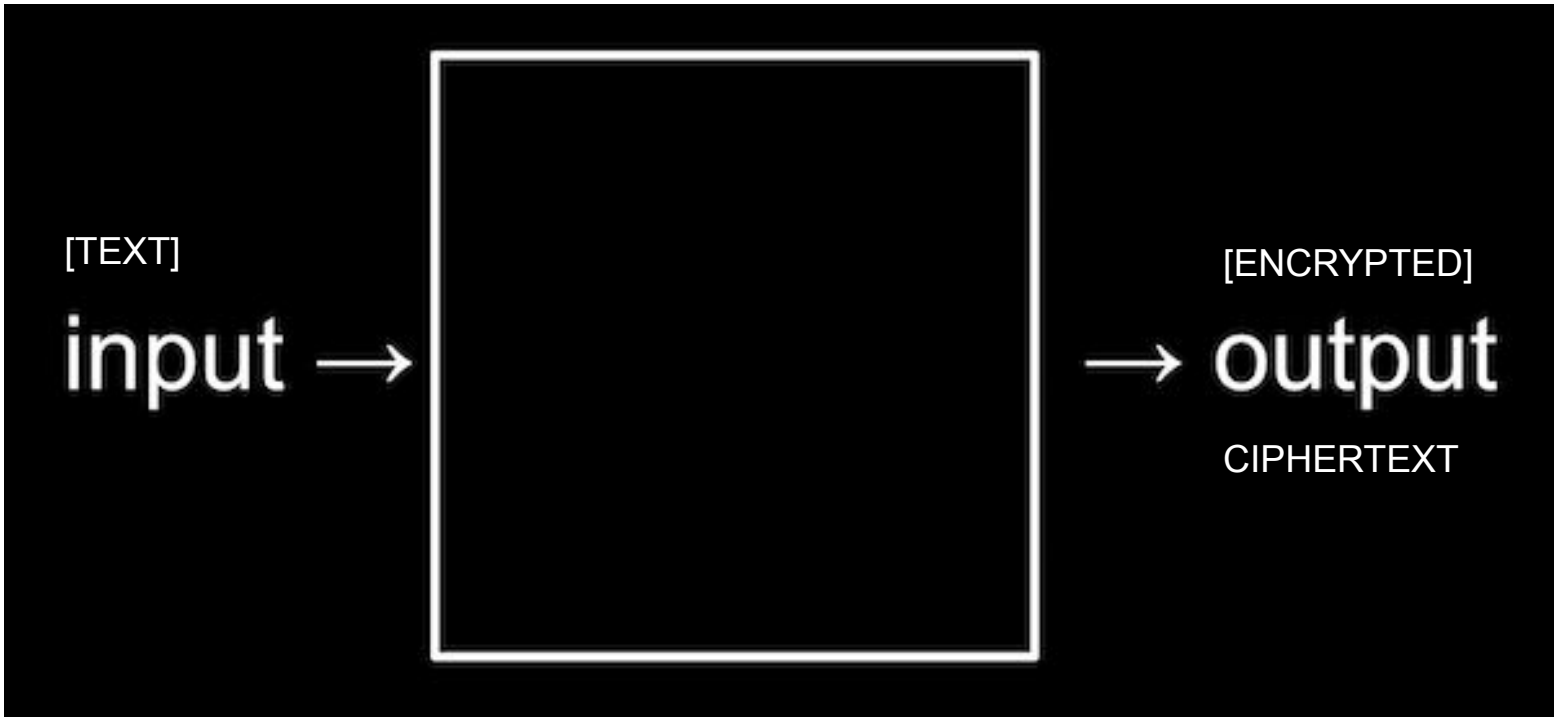
🤖 MIDTERM!

- Review on 10.24 and 10.27, based on survey
- HACKATHON TEAMS also on 10.27, ***attendence required***
- You can use any resources (with citation!)
- In-class work 10.27, 10.29, Fri. 10.31
- Code due + individual questions due 10.31 👻🎃


Days before OpenAI
Developer coding
- 2 hours
Developer debugging
- 6 hours
Days after OpenAI
ChatGPT generates
Codes - 5 min
Developer debugging
- 24 hours


mail.at(0)
mail.at(1)
mail.at(2)
mail.at(3)
mail.at(4)
mail.at(5)
203
204
302
303
304

`cryptography = hidden writing (Greek)`

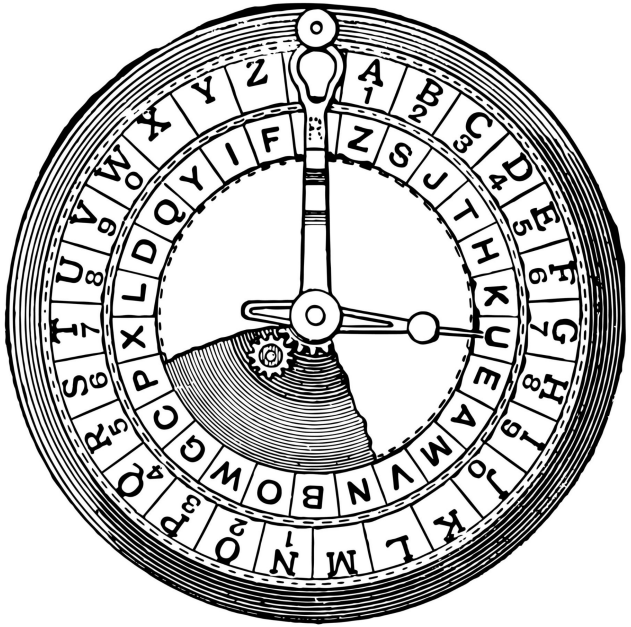


From Harvard CS50

cipher, cypher

- Origins: meant “zero” or circle
- Then meant number, doing arithmetic
- Then meant ***encoding*** text, hidden

cipher, cypher



Caesar cipher

Caesar shift

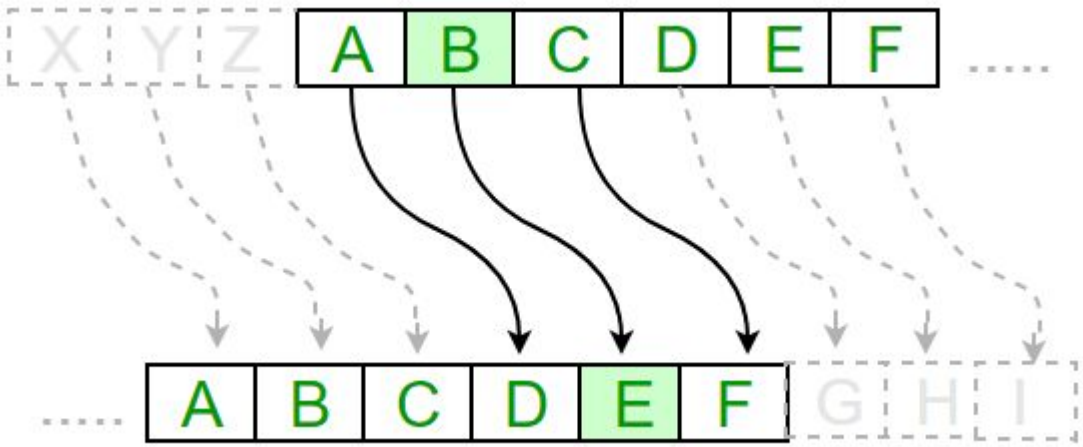
Substitution cipher

military messages, 1st cent. CE

Original Message: “AT DAWN”

SHIFT, or KEY: 3

Encrypted Message: “DW GDZQ”




N O P Q R S T U V W X Y Z A B C D E F G H I J K L M
A Z Y X W V U T S R Q P O N M L K J I H G F E D C B

Wikimedia

Caesar shift in c++ :

- 🔑 shift as input, integer
- Decrypted ciphertext as output
- 2 vectors: 1 container for input text, 1 container for output text
- Nested loops: loop for the word, loop for the character; SHIFT EACH LETTER BY KEY, <INT>
- Alphabet table: ASCII!!

ENCRYPT

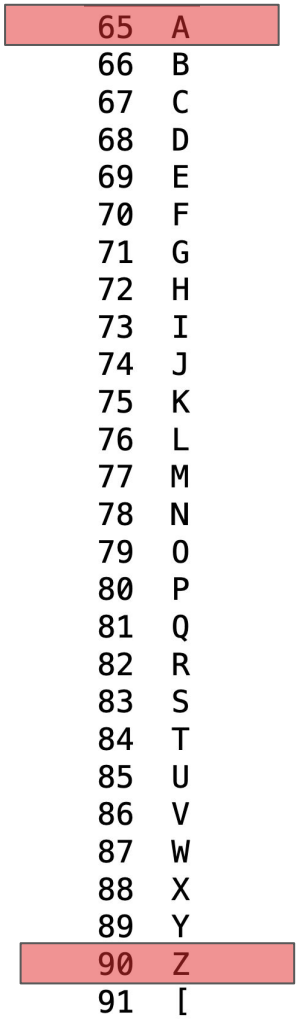
🔑 = 1

90 - 65 = 25

25 + 🔑 = 26

26 % 26 = 0

0 + 65 = 65 = A



26 letters in alphabet

https://cs103-proton2.glitch.me/

$$E_n(x) = (x + n) \mod 26.$$

DECRYPT

🔑 = 1

65 - 65 = 0

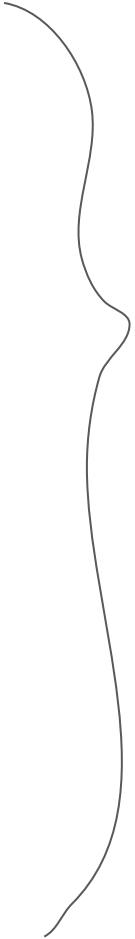
0 - 🔑 = -1

-1 + 26 = 25

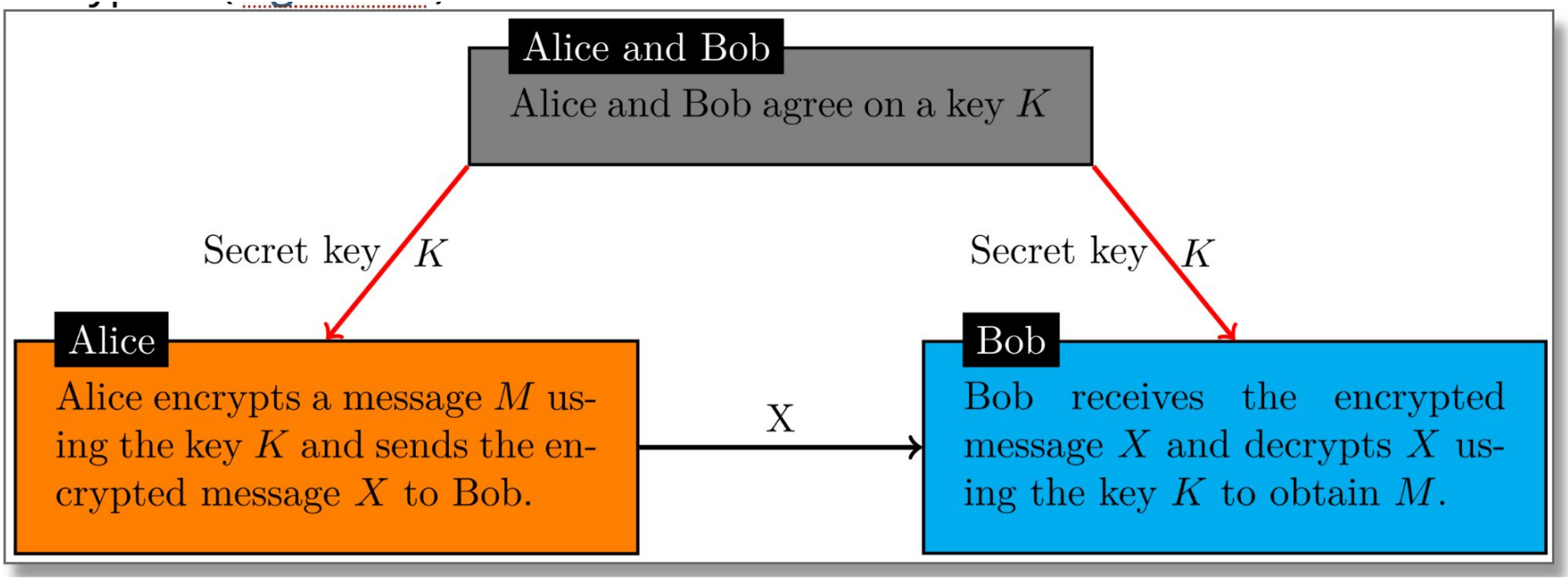
25 % 26 = 25

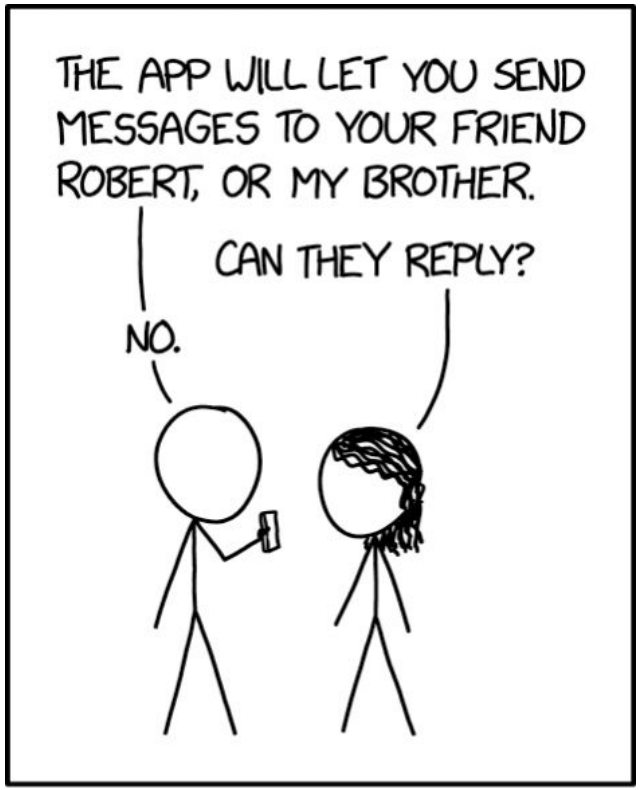
25 + 65 = 90 = Z

65	A
66	B
67	C
68	D
69	E
70	F
71	G
72	H
73	I
74	J
75	K
76	L
77	M
78	N
79	O
80	P
81	Q
82	R
83	S
84	T
85	U
86	V
87	W
88	X
89	Y
90	Z
91	[



26 letters in alphabet


Alice and Bob
Alice and Bob agree on a key K
Secret key K
Secret key K
Alice
Alice encrypts a message M using the key K and sends the encrypted message X to Bob.
X
Bob
Bob receives the encrypted message X and decrypts X using the key K to obtain M.



MY NEW SECURE TEXTING APP ONLY ALLOWS PEOPLE NAMED ALICE TO SEND MESSAGES TO PEOPLE NAMED BOB.

vectors vs. arrays?

```
vector<int> myNumbers(20);

int myNumbers[20];
```

vectors vs. arrays

- **BIG DIFFERENCE:**
  YOU CANNOT SIMPLY RESIZE ARRAYS!

- This makes arrays faster, if you are *really* in need of speedy performance (large, large datasets)

- Arrays don’t need a header #include

- For our purposes, simpler to use dynamic vectors

myContainer.at(i) vs. myContainer[i]

- .at() function checks the size of your container
- [] does not check the range!
- Both work for vectors
- Only [] works for built-in arrays … BUT …

C-strings vs. **strings** (C++)

```
char myWord[6] = “hello”;
string myWord = “hello”;
```

- C-string = older, from C, built-in
- Literally array of characters, with ‘\0’ to **END** (size = +1)
- Different library of functions than C++ strings
- Easy to make mistakes with!

Why learn arrays + C-strings?

- We still see them in code (“legacy”)
- Good to understand the most basic data types (like … binary) to know where our more advanced features come from!
- Vectors came from limitations with arrays, the standard template string from limitations with C-strings, etc.!

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