Q: What will the following expression report?

iClicker

A. True

B. False

CPSC 100

Computational Thinking

Intro to Data Representation

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Department of Computer Science
University of British Columbia

Agenda

- Learning Goals
- Course Admin
- Intro to Data Representation
  - Activity
  - Counting in Binary

Learning Goals

After this today's lecture, you should be able to:

- Recognize binary's role in data representation
- Understand that binary (base-2) is the fundamental numbering system used in computing.
  - Explain why computers use binary
- Convert given decimal numbers (e.g., 13) into binary.
- Perform a binary "magic trick" to identify numbers using logical reasoning
- *Bonus: Count up to 32 using 1 hand*

Course Admin

Course Admin

- **Project Milestone 1**
  - Due on Wednesday, Feb 12 at 11:59pm
- **Midterm**
  - Review exam details here
  - You're allowed a cheat sheet: **1 side of an A4 sized paper**
  - 📅 February 14 💘
  - ⏰ 3:00-3:50 pm
  - ‼️⚠️ CHBE 101 [**Ch**emical and **B**iological **E**ngineering Building] ⚠️‼️
  - Practice Problems available here
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Data Representation


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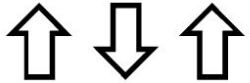
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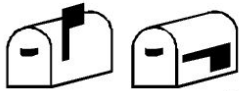
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Activity

Binary Magic Card Trick

- Give the 6 card sets to the person beside you
- Ask them to:
  - Look at the cards blocks (A/B/C/D/E/F)
  - Choose **a number** that occurs on at least one of the cards, and then
  - Make 2 lists: one with all the cards that contain the chosen number, and another with the cards that don't contain the number.
- **Challenge: Can you identify which number they chose?**

2	3	6	7	10	11	14	15
18	19	22	23	26	27	30	31
34	35	38	39	42	43	46	47
50	51	54	55	58	59	62	63

A

16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

B

8	9	10	11	12	13	14	15
24	25	26	27	28	29	30	31
40	41	42	43	44	45	46	47
56	57	58	59	60	61	62	63

C

1	3	5	7	9	11	13	15
17	19	21	23	25	27	29	31
33	35	37	39	41	43	45	47
49	51	53	55	57	59	61	63

D

4	5	6	7	12	13	14	15
20	21	22	23	28	29	30	31
36	37	38	39	44	45	46	47
52	53	54	55	60	61	62	63

E

32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

F

Can you identify their number?

Solution

Binary Magic Card Trick

- The trick is to take the list of card sets that contains their number and simply add the **upper-left number from each card**.
- The sum of these values will be the number that was chosen

- But what does this have to do with binary?

2	3	6	7	10	11	14	15
18	19	22	23	26	27	30	31
34	35	38	39	42	43	46	47
50	51	54	55	58	59	62	63

#	Binary	#	Binary	#	Binary	#	Binary
2	000010	18	010010	34	100010	50	110010
3	000011	19	010011	35	100011	51	110011
6	000110	22	010110	38	100110	54	110110
7	000111	23	010111	39	100111	55	110111
10	001010	26	011010	42	101010	58	111010
11	001011	27	011011	43	101011	59	111011
14	001110	30	011110	46	101110	62	111110
15	001111	31	011111	47	101111	63	111111

Binary Magic Card Trick

- Binary numbers only use two digits: 0 and 1, and their place values are based on powers of 2.

Number 9 in Binary:

256	128	64	32	16	8	4	2	1
0	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**

9 = 000001001

Q: What is the binary number for 15?

iClicker

A. 01111

B. 00101

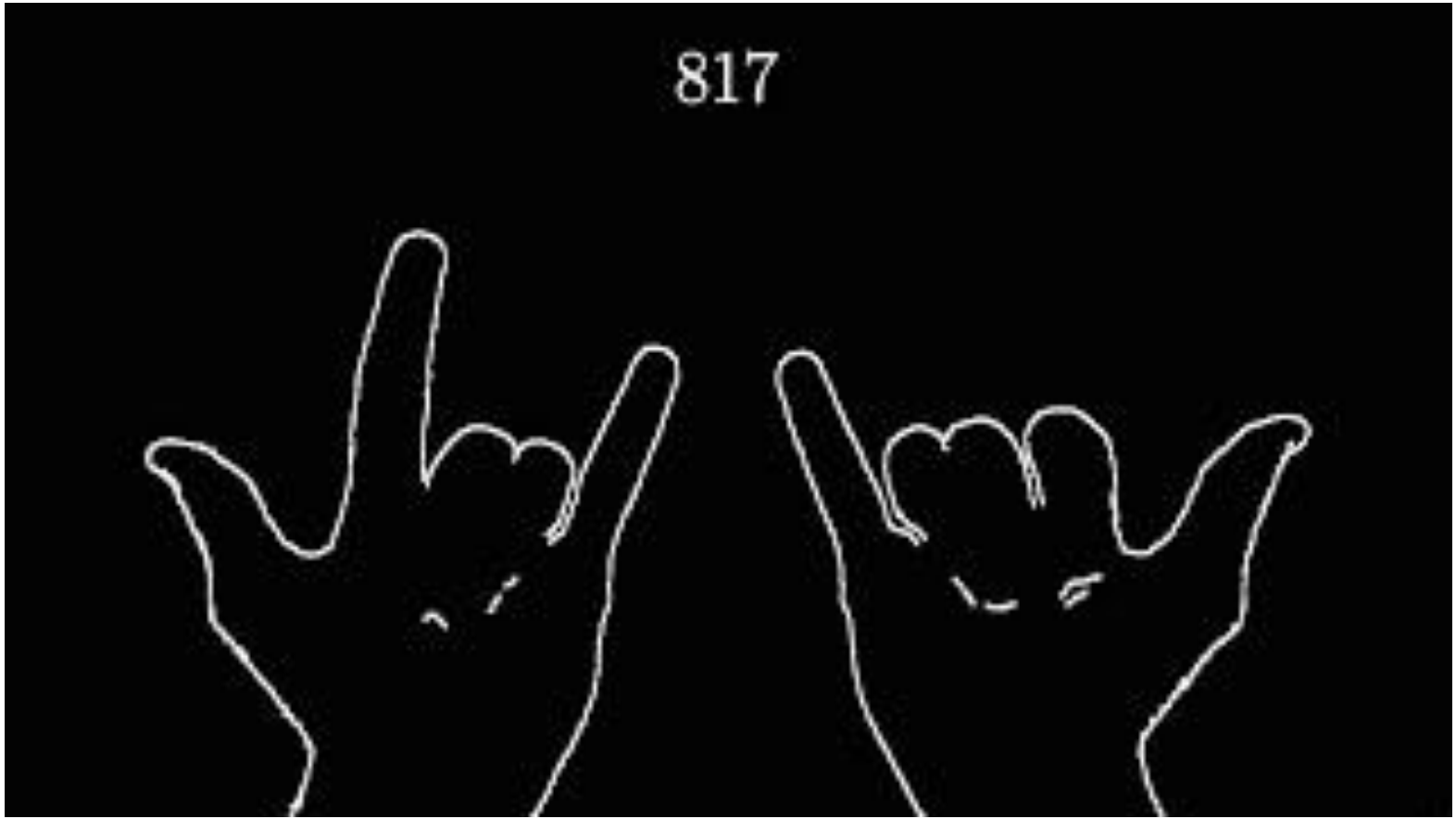
C. 10001

D. 01000

E. 10111

Birthday in Binary

https://www.youtube.com/watch?v=1SMmc9gQmHQ&ab_channel=3Blue1Brown



Take-Home Practice

Convert these numbers to binary

- 16
- 27
- 30
- 58
- 98
- 78
- 100
- 9
- 34

Wrap up

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