

**SIGNED BIN.
NUMBERS AND BIN.
SUBTRACTION**

NEGATIVE NUMBERS

WITH TYPICAL MATH...

- A (-) SIGN INDICATES THAT THE NUMBER IS NEGATIVE
- COMPUTERS CAN ONLY USE 1'S OR 0'S... HOW TO INDICATE POSITIVE/NEGATIVE?
- MANY WAYS...
- THE FIRST CHOSEN WAY: FLIP ALL THE BITS
- THIS MEANS:
 - "-0110" = 1001
- BINARY MATH USING THIS CONVENTION CALLED "ONES COMPLEMENT SIGNED ARITHMETIC"



A BETTER WAY

TWO'S COMPLEMENT

▪COMPUTER SCIENTISTS QUICKLY REALIZED THAT ONE'S COMPLEMENT ARITHMETIC WAS "CLUNKY"

▪A BETTER WAY WAS FORMED

▪TO NEGATE A NUMBER, FLIP THE BITS, THEN ADD 1

▪BINARY MATH USING THIS CONVENTION IS CALLED "TWO'S COMPLEMENT SIGNED ARITHMETIC"



THE RESULTS

THE PROS

- MATH USING TWOS COMPLEMENT IS DONE EXACTLY THE SAME AS WE WOULD HAVE DONE USING UNSIGNED BINARY NUMBERS

- SUBTRACTION IS MUCH EASIER (MORE ON THIS LATER)

TAKE NOTE:

- A RESULT OF THIS METHOD IS THAT ALL NUMBERS THAT START WITH A "1" ARE NEGATIVE, AND THOSE THAT START WITH A "0" OR POSITIVE



AN EXAMPLE

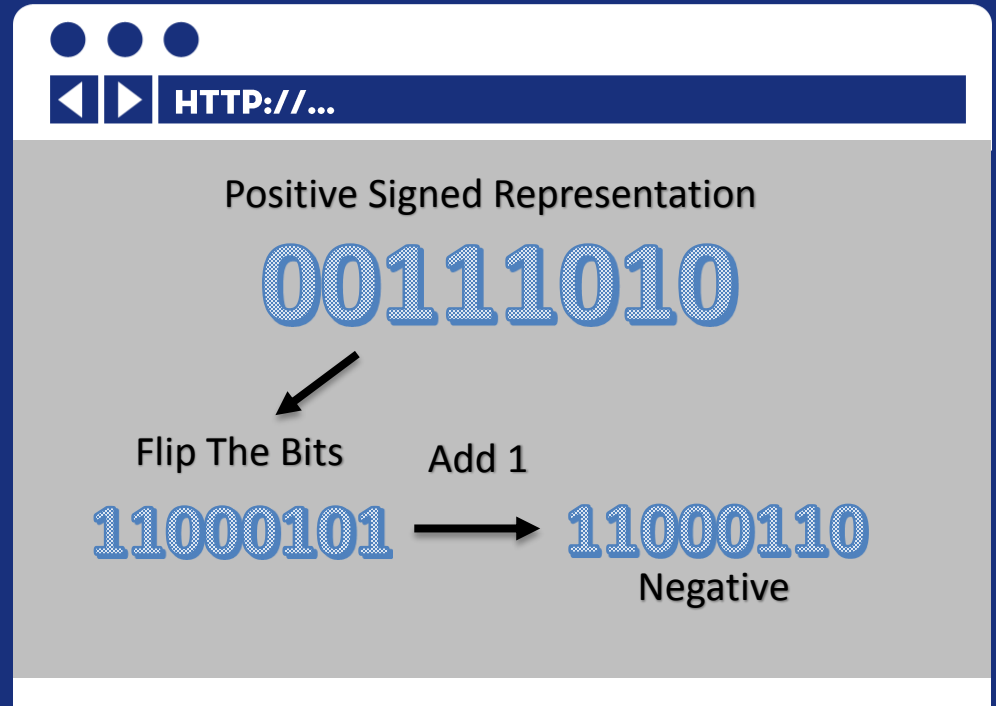
NEGATING USING '2'S COMP.'

▪THE QUESTION WILL HAVE WORDING
SOMETHING LIKE THIS:

▪'GIVE THE TWOS COMPLEMENT
NEGATION OF THIS BINARY
NUMBER'

▪REMEMBER:

- FLIP THE BITS
- ADD 1 (CARRY IF NECESSARY)



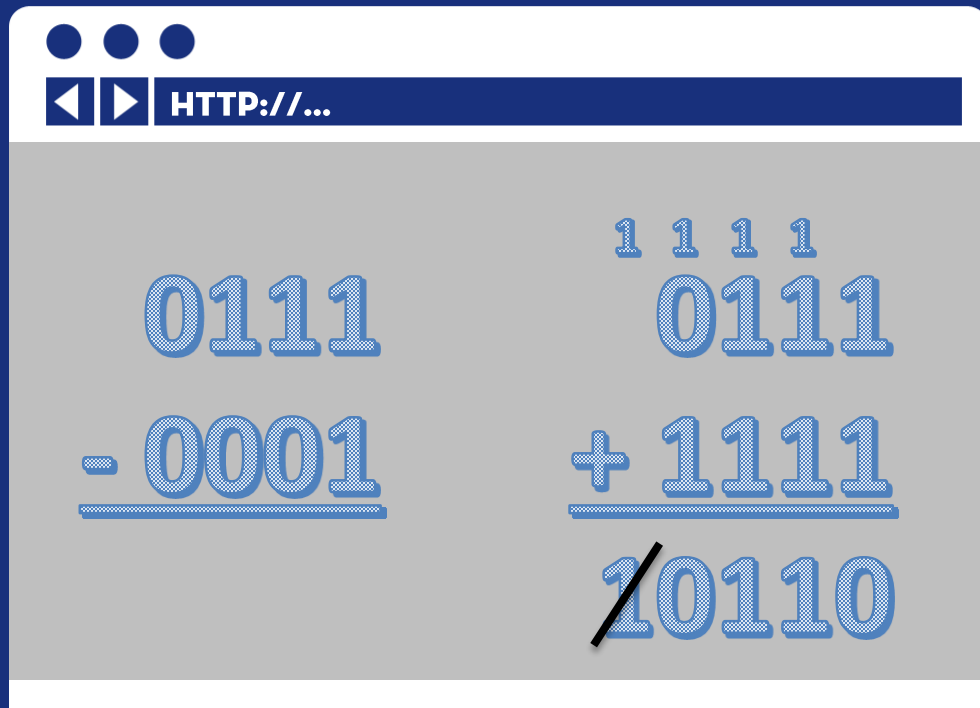
BINARY SUBTRACTION

ADD THE NEGATIVE

▪ WITH THE TWO'S COMPLEMENT REPRESENTATION, SUBTRACTION IS RELATIVELY SIMPLE:

- NEGATE THE SUBTRACTED NUMBER
- ADD INSTEAD

▪ FINAL STEP: THROW AWAY THE LAST CARRY (IF THERE IS ONE)



THE END!