Goldbach's Conjecture in C

2025 Winter APS105: Computer Fundamentals
Jon Eyolfson

Lecture 15
1.0.0

Let’s Write a C Program to Test Goldbach’s Conjecture

“Every even integer greater than 2 is the sum of two prime numbers”

This Lecture is Done Live

You'll find an example solution in the next slides for reference

However, don't look at it before class, we'll develop the program together!

Example Solution (1/6)

```c
#include <stdbool.h>
#include <stdio.h>
#include <stdlib.h>

int userInput(void);
void conjectureOutput(int x);
bool isPrime(int x);
int nextPrime(int x);
bool conjectureHolds(int x, int* first, int* second);

int main(void) {
    int x = userInput();
    conjectureOutput(x);
    return EXIT_SUCCESS;
}
```

Example Solution (2/6)

```
int userInput(void) {
    int input = 0;
    printf("Enter an even number >2 to test the Goldback conjecture: ");
    scanf("%d", &input);
    while (input % 2 != 0  input <= 2) {
        printf("Your input was invalid, please enter aven even number >2: ");
        scanf("%d", &input);
    }
    return input;
}
```

Example Solution (3/6)

```
bool isPrime(int x) {
    if (x == 1) {
        return false;
    }
    for (int divisor = 2; divisor < x; ++divisor) {
        if (x % divisor == 0) {
            return false;
        }
    }
    return true;
}
```

Example Solution (4/6)

```
int nextPrime(int x) {
    do {
        ++x;
    } while (!isPrime(x));
    return x;
}
```

Example Solution (5/6)

```
bool conjectureHolds(int x, int *first, int *second) {
    *first = 2;
    *second = x - *first;
    while (*first <= *second) {
        if (isPrime(*second)) {
            return true;
        }

        *first = nextPrime(*first);
        *second = x - *first;
    }
    return false;
}
```

Example Solution (6/6)

```
void conjectureOutput(int x) {
    int first = 0;
    int second = 0;
    if (conjectureHolds(x, &first, &second)) {
        printf("Goldbach's conjecture holds for %d: %d and %d\n", x, first, second);
    }
    else {
        printf("Goldbach's conjecture DOES NOT hold for %d\n", x);
    }
}
```