

CS2263 Assignment 1

Kohdy Nicholson

fibprime.c:

```
/*
    fibprime.c

    Description:
    Program that determines if a number is fib and prime.

    Author:
    Kohdy Nicholson

    Date:
    2020-05-06
*/

#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include "helpers.h"

int main(int argc, char** argv){
    int lower, upper, prime, fib, result, range_size;
    double execution_time = 0.0;

    int input;

    printf("\nPlease enter a lower range value: ");
    input = scanf("%d", &lower);

    if(input != 1){
        printf("Unable to read the value.\n");
        return 1;
    }

    printf("Now, enter an upper range value: ");
    input = scanf("%d", &upper);

    if(input != 1){
        printf("Unable to read the value.\n");
        return 1;
    }
}
```

```

    clock_t start = clock();

    if(lower > upper){
        printf("Please ensure the lower value is either equal to or lower than the upper value. Exiting...\n\n");
        return EXIT_FAILURE;
    }

    // Declare array with the proper size.
    range_size = (upper - lower) + 1;

    for(int i = 0; i < range_size; i++){
        fib = isfib(lower);
        if(fib == 1){
            prime = isprime(lower);
            if(prime == 1){
                printf("\n%d is a fib prime number.", lower);
            }
        }
        lower++;
    }

    clock_t finish = clock();
    execution_time += (double)(finish - start) / CLOCKS_PER_SEC;

    printf("\n\nThis program took %f seconds to execute.\n\n", execution_time);
    return EXIT_SUCCESS;
}

```

fibprime.exe output:

```
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> gcc isfib.c isprime.c fibprime.c -o fibprime
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe

Please enter a lower range value: 42
Now, enter an upper range value: 0
Please ensure the lower value is either equal to or lower than the upper value. Exiting...

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe

Please enter a lower range value: -42
Now, enter an upper range value: 100

1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.

This program took 0.001000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe

Please enter a lower range value: 10
Now, enter an upper range value: 100

13 is a fib prime number.
89 is a fib prime number.

This program took 0.000000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe

Please enter a lower range value: 1597
Now, enter an upper range value: 1597

1597 is a fib prime number.

This program took 0.000000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe

Please enter a lower range value: 0
Now, enter an upper range value: 100000

1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.

This program took 16.631000 seconds to execute.
```

Faster runtimes:

```
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
```

```
Please enter a lower range value: 0  
Now, enter an upper range value: 100000
```

```
Range Size: 100001  
1 is a fib prime number.  
2 is a fib prime number.  
3 is a fib prime number.  
5 is a fib prime number.  
13 is a fib prime number.  
89 is a fib prime number.  
233 is a fib prime number.  
1597 is a fib prime number.  
28657 is a fib prime number.
```

```
This program took 0.010000 seconds to execute.
```

```
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
```

```
Please enter a lower range value: 0  
Now, enter an upper range value: 1000000
```

```
Range Size: 1000001  
1 is a fib prime number.  
2 is a fib prime number.  
3 is a fib prime number.  
5 is a fib prime number.  
13 is a fib prime number.  
89 is a fib prime number.  
233 is a fib prime number.  
1597 is a fib prime number.  
28657 is a fib prime number.  
514229 is a fib prime number.
```

```
This program took 0.078000 seconds to execute.
```

```
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
```

```
Please enter a lower range value: 0  
Now, enter an upper range value: 10000000
```

```
Range Size: 10000001  
1 is a fib prime number.  
2 is a fib prime number.  
3 is a fib prime number.  
5 is a fib prime number.  
13 is a fib prime number.  
89 is a fib prime number.  
233 is a fib prime number.  
1597 is a fib prime number.  
28657 is a fib prime number.  
514229 is a fib prime number.
```

```
This program took 0.818000 seconds to execute.
```

```
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
```

```
Please enter a lower range value: 0  
Now, enter an upper range value: 100000000
```

```
Range Size: 100000001  
1 is a fib prime number.  
2 is a fib prime number.  
3 is a fib prime number.  
5 is a fib prime number.  
13 is a fib prime number.  
89 is a fib prime number.  
233 is a fib prime number.  
1597 is a fib prime number.  
28657 is a fib prime number.  
514229 is a fib prime number.
```

```
This program took 9.842000 seconds to execute.
```

fibprime_optimal.c:

```

/*
    fibprime_optimal.c

    Description:
    Program that determines if a number is fib and prime in an optimal way.

    Author:
    Kohdy Nicholson

    Date:
    2020-05-06
*/

#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include "helpers.h"

int main(int argc, char** argv){
    int lower, upper, input, prime;
    int fib_num, next_fib_num, i, j;
    int arr[255];
    double execution_time = 0.0;

    printf("\nPlease enter a lower range value: ");
    input = scanf("%d", &lower);

    if(input != 1){
        printf("Unable to read the value.\n");
        return 1;
    }

    printf("Now, enter an upper range value: ");
    input = scanf("%d", &upper);

    if(input != 1){
        printf("Unable to read the value.\n");
        return 1;
    }

    clock_t start = clock();

    if(lower > upper){
        printf("Please ensure the lower value is either equal to or lower than the upper value. Exiting...\n\n");
    }

```

```

        return EXIT_FAILURE;
    }

    // Initialize array with fib sequence until we surpass the upper value
    fib_num = 0;
    next_fib_num = 1;
    i = 0;
    while(fib_num <= upper){
        arr[i] = fib_num;
        fib_num = next_fib_num;
        next_fib_num += arr[i];
        i++;
    }

    j = 0;
    while(j < i){
        if(arr[j] >= lower){
            prime = isprime(arr[j]);
            if(prime == 1){
                printf("\n%d is a fib prime number.", arr[j]);
            }
        }
        j++;
    }

    clock_t finish = clock();
    execution_time += (double)(finish - start) / CLOCKS_PER_SEC;

    printf("\n\nThis program took %f seconds to execute.\n\n", execution_time);
    return EXIT_SUCCESS;
}

```

fibprime.exe vs. fibprime_optimal.exe:


```

Now, enter an upper range value: 1000
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.

This program took 0.003000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
Please enter a lower range value: 0
Now, enter an upper range value: 10000
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.

This program took 0.160000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
Please enter a lower range value: 0
Now, enter an upper range value: 100000
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.

This program took 16.226000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime.exe
Please enter a lower range value: 0
Now, enter an upper range value: 1000000
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.
102259 is a fib prime number.
PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> took too long...

```

```

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime_optimal.exe
Please enter a lower range value: 0
Now, enter an upper range value: 1000
1 is a fib prime number.
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.

This program took 0.004000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime_optimal.exe
Please enter a lower range value: 0
Now, enter an upper range value: 100000
1 is a fib prime number.
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.

This program took 0.003000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime_optimal.exe
Please enter a lower range value: 0
Now, enter an upper range value: 1000000
1 is a fib prime number.
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.
28657 is a fib prime number.

This program took 0.002000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime_optimal.exe
Please enter a lower range value: 0
Now, enter an upper range value: 10000000
1 is a fib prime number.
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.
28657 is a fib prime number.
514229 is a fib prime number.

This program took 0.028000 seconds to execute.

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F>

```

```

PS C:\Users\Kohdy\Documents\CS2263\W1Ass\F> .\fibprime_optimal.exe
Please enter a lower range value: 0
Now, enter an upper range value: 1000000000
1 is a fib prime number.
1 is a fib prime number.
2 is a fib prime number.
3 is a fib prime number.
5 is a fib prime number.
13 is a fib prime number.
89 is a fib prime number.
233 is a fib prime number.
1597 is a fib prime number.
28657 is a fib prime number.
514229 is a fib prime number.
433494437 is a fib prime number.

This program took 2.980000 seconds to execute.

```

You might notice two things:

1. fibprime_optimal is MUCH faster. On a range of one million we were able to process all the fib prime numbers in less than one second.
2. fibprime fails to work properly after the number becomes too big. This is because I am using binet's formula, which takes the square of a number, multiplies it by 5, subtracts and adds 4 and determines if the result is a perfect square. Well, when our number becomes too large, it seems like it cause an integer overflow. Therefore, it does not pick up 28657, or 514229 (also because it was just taking too long).

One solution for this is to simply have a different algorithm for finding if a number is a fib number by creating the fibonacci sequence for everyone number in the range. This would result in longer wait times. I think it is fine the way it is, and demonstrates the idea well enough.

Directory Listing:

```
PS C:\Users\Kohdy\Documents\CS2263\w1Ass\F> dir

Directory: C:\Users\Kohdy\Documents\CS2263\w1Ass\F

Mode                LastWriteTime         Length Name
----                -
-a----          2020-05-07   1:07 PM           1280 fibprime.c
-a----          2020-05-07   1:10 PM          47255 fibprime.exe
-a----          2020-05-07   1:30 PM           1526 fibprime_optimal.c
-a----          2020-05-07   1:35 PM          47255 fibprime_optimal.exe
-a----          2020-05-07   9:58 AM            643 findingfibs.c
-a----          2020-05-07   1:14 PM            212 helpers.h
-a----          2020-05-07  10:10 AM            671 isfib.c
-a----          2020-05-06   5:15 PM            525 isprime.c
-a----          2020-05-07   1:13 PM         235408 Report.docx
```