

Stats102A, Summer 2023 - Homework 1

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```
source("206039397_stats102a_hw1.R")
```

Greatest Common Divisor Algorithm

```
INPUT val1, val2

IF val1 has decimals OR val2 has decimals
  STOP
END IF

IF val1 > val2
  SET bigval = val1
  SET smallval = val2
END IF
ELSE
  SET bigval = val2
  SET smallval = val1
END ELSE

SET rval = bigval MODULUS smallval

WHILE rval != 0
  SET bigval = smallval
  SET smallval = rval
  SET rval = bigval MODULUS smallval
END WHILE

RETURN rval
```

Least Common Multiple Algorithm

```
INPUT vec

IF length(vec) < 2 OR length(vec) > 100
  STOP program
END IF
```

```

IF any of vec are decimals
  STOP
END IF

SET total = vec[0]
SET vec = vec[1:length(vec)]

FOR i in 0:length(vec)
  total = (total * vec[i])/gcd(total, vec[i])
end for

RETURN total

```

Prime Factorization Algorithm

```

FUNCTION get_factors
  INPUT n

  IF n has decimals
    STOP
  END IF

  DECLARE list[]

  FOR i = 2 UNTIL i == n - 1
    IF is_prime(i) AND n %% i == 0 AND i not in list[primes]
      SET expCount = 0
      SET temp_num = n
      WHILE temp_num %% i == 0
        SET expCount += 1
        SET temp_num /= i
      END WHILE
      SET list[primes] += i
      SET list[exponents] += expCount
    END IF
  END FOR

  IF list is empty
    list = list[primes] + n
    list = list[exponents] + 1
  END IF

  list = 1 + list[primes]
  list = 1 + list[exponents]

  RETURN list
END FUNCTION

FUNCTION is_prime
  INPUT num

```

```

    IF any are decimals
      STOP
    END IF

    SET primebool = TRUE

    FOR i = 2 UNTIL i == num - 1
      IF num MODULUS i == 0
        SET primebool = FALSE
      END IF
    END FOR

    RETURN primebool
END FUNCTION

```

GCD/LCM Showcase

```
gcd(72, 8)
```

```
## [1] 8
```

```
gcd(-1,531)
```

```
## [1] 1
```

```
gcd(47011,73618)
```

```
## [1] 1
```

```
gcd(1,NA)
```

```
## Error in gcd(1, NA): Input is NA, NAN, or NULL
```

```
lcm(c(-12,21))
```

```
## [1] 84
```

```
lcm(c(-12,21))
```

```
## [1] 84
```

```
lcm(c(4789,6123,199))
```

```
## [1] 5835286353
```

```
lcm(c(NA,2,-1))
```

```
## Error in lcm(c(NA, 2, -1)): Input has NA, NAN, or NULL
```

Prime Factorization Showcase

```
is_prime(c(9,7))
```

```
## [1] FALSE TRUE
```

```
get_factors(1920)
```

```
## $primes  
## [1] 1 2 3 5  
##  
## $exponents  
## [1] 1 7 1 1
```

```
get_factors(1.92)
```

```
## Error in get_factors(1.92): Error: input is not an integer
```

```
x <- sample(x = 1e4, size = 1)  
y <- get_factors(x)  
this_works <- prod(y$primes^y$exponents) == x & all(is_prime(y$primes))  
this_works
```

```
## [1] TRUE
```

```
get_factors(NA)
```

```
## Error in get_factors(NA): Input is NA, NAN, or NULL
```