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Solution

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Informatics II
Exercise 2 / **Solution**

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Recursion

Solution: The function first prints the number n, then it checks the base condition for $n = 1$. If base condition is reached then simply returns, otherwise makes a recursive call with the new value in the sequence.

Task 1

```
Algo: SEQUENCE(n)
Print n
if $n == 1$ then
    return
if $n\%2 == 0$ then
    $n = n/2$
else
    $n = 3n + 1$
call SEQUENCE(n)
```

Task 2

Solution Start with a binary string having one character either ’0’ or ’1’ using the function `GENERATEBINARYSTRINGS`. Then, recursively call `GENERATE` function, which append ’0’ or ’1’ to the binary string. However, only append ’1’ if the previous character in the binary string is ’0’.

```
Algo: generateBinaryStrings(k)

if $k \leq 0$ then
    return
Declare character array ’str’ of size ’k’
str[0] = ’0’
generate(str,k,1)
str[0] = ’1’
generate(str,k,1)
```

```
Algo: generate(str,k,n)

if $n == k$ then
    str[n] = ’\0’
    print str
    return
if $str[n-1] ==' 1'$ then
    str[n] = ’0’
    generate(str,k,n+1)
if $str[n-1] ==' 0'$ then
    str[n] = ’0’
    generate(str,k,n+1)
    str[n] = ’1’
    generate(str,k,n+1)
```

Task 3a

Solution Given a square with the coordinates (x,y) of its lower left corner and length l, you can compute the coordinates of all four corners for the next recursion call of T-square fractal as shown in Figure 1.

```
Algo: TSquareFractal(x,y,length,iter)

if $iter == 0$ then
    return;
Print x,y, length
TSquareFractal(x-length/4, y-length/4, length/2, iter-1);
TSquareFractal(x-length/4, y+ (3.0/4.0)*length, length/2, iter-1);
TSquareFractal(x+(3.0/4.0)*length, y-length/4, length/2, iter-1);
TSquareFractal(x+(3.0/4.0)*length, y+(3.0/4.0)*length, length/2, iter-1);
```

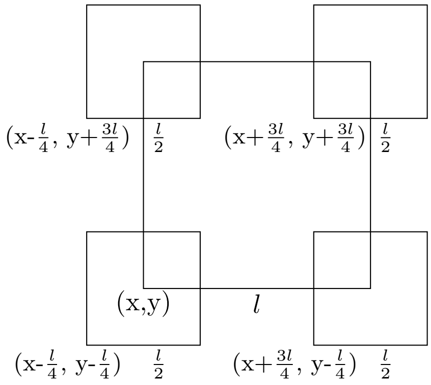
(x-$\frac{l}{4}$, y+$\frac{3l}{4}$)
$\frac{l}{2}$
(x+$\frac{3l}{4}$, y+$\frac{3l}{4}$)
$\frac{l}{2}$
(x,y)
l
(x-$\frac{l}{4}$, y-$\frac{l}{4}$)
$\frac{l}{2}$
(x+$\frac{3l}{4}$, y-$\frac{l}{4}$)
$\frac{l}{2}$

Figure 1

Task 3b

Solution Instead of printing, use the SDL functions to draw the rectangle.

```
Algo: TSquareFractal(x,y,length,iter)

if iter == 0 then
  return;
SDL_Rect(x,y, length)

TSquareFractal(x-length/4, y-length/4, length/2, iter-1);
TSquareFractal(x-length/4, y+ (3.0/4.0)*length, length/2, iter-1);
TSquareFractal(x+(3.0/4.0)*length, y-length/4, length/2, iter-1);
TSquareFractal(x+(3.0/4.0)*length, y+(3.0/4.0)*length, length/2, iter-1);
```