HW3

R12521601 詹承諺

HW3-1:

```
str11 = ""
str57 = ""
str27 = ""
strno27 = ""
for i in range(1, 51):
    if i % 11 == 0:
        str11 += str(i)
        str11 += " "
for j in range(1, 31):
    if (j % 5 == 0) or (j % 7 == 0):
        str57 += str(j)
        str57 += " "
    if (j % 2 == 0) and (j % 7 == 0):
        str27 += str(j)
        str27 += " "
for k in range(1, 21):
    if (k % 2 != 0) and (k % 7 != 0):
        strno27 += str(k)
        strno27 += " "

print("integers from 1 to 50 divisible by 11: "+str11)
print("integers from 1 to 30 divisible by 5 or 7: "+str57)
print("integers fom 1 to 30 divisible by 2 and 7: "+str27)
print("integers from 1 to 20 not divisible by 2 nor 7: "+strno27)
```

✓ 0.0s

```
integers from 1 to 50 divisible by 11: 11 22 33 44
integers from 1 to 30 divisible by 5 or 7: 5 7 10 14 15 20 21 25 28 30
integers fom 1 to 30 divisible by 2 and 7: 14 28
integers from 1 to 20 not divisible by 2 nor 7: 1 3 5 9 11 13 15 17 19
```

HW3-2:

```
1
Please input N for the Factorial: (按 'Enter' 鍵確認或按 'Esc' 鍵取消)
```

```
The Factorial =
1
```

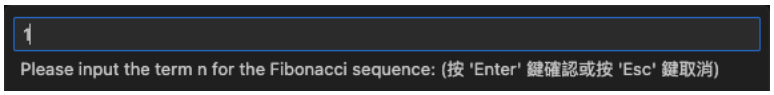
```
2
Please input N for the Factorial: (按 'Enter' 鍵確認或按 'Esc' 鍵取消)
```

```
The Factorial =
2
```

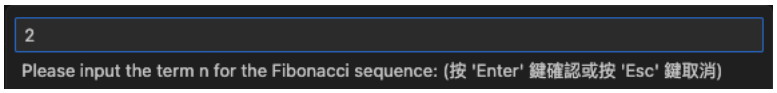
```
5
Please input N for the Factorial: (按 'Enter' 鍵確認或按 'Esc' 鍵取消)
```

```
The Factorial =
120
```

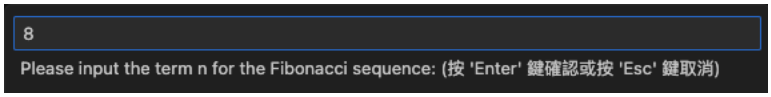
HW3-3:




```
The Fibonacci sequence =
1
```




```
The Fibonacci sequence =
1 1
```




```
The Fibonacci sequence =
1 1 2 3 5 8 13 21
```

Simplex method:

The Simplex method is a method to find an optimal solution for linear programs. To get this solution, we start at a vertex and move from another improving the value of the objective function.

HW3-4:

HW 3-4

$\max z = -x_1 + 3x_2 - 3x_3$

s.t.

$s_1 = 7 - 3x_1 + x_2 + 2x_3$

$s_2 = 3 + 2x_1 + 4x_2 - 4x_3$

$s_3 = 4 - x_1 + 2x_3$

$s_4 = 8 + 2x_1 - 2x_2 - x_3$

$s_5 = 5 - 3x_1$

$x_1, x_2, x_3, s_1, s_2, s_3 \geq 0$

pivot on x_2

$(x_1, x_2, x_3, s_1, s_2, s_3, s_4, s_5)$
$= (0, 0, 0, 7, 3, 4, 8, 5)$

$\exists \quad s_3 = 4 - x_1 + 2x_3$

$s_4 = 8 + 2x_1 - 2x_2 - x_3 \Rightarrow x_2 \leq 4 \exists \; x_2 = 4 + x_1 - \frac{1}{2}x_3 - \frac{1}{2}s_4$

$s_5 = 5 - 3x_1$

$x_1, x_2, x_3, s_1, s_2, s_3 \geq 0$

$x_1 = 0$	$s_4 = 0$
$x_2 = 4$	$s_5 = 5$
$x_3 = 0$	
$s_1 = 11$	
$s_2 = 19$	
$s_3 = 4$	

$\exists \quad \max z = 12 + 2x_1 - \frac{9}{2}x_3 - \frac{3}{2}s_4$

s.t.

$s_1 = 11 - 2x_1 + \frac{3}{2}x_3 - \frac{1}{2}s_4$

$s_2 = 19 + 6x_1 - 6x_3 - 2s_4$

$s_3 = 4 - x_1 + 2x_3$

$x_2 = 4 + x_1 - \frac{1}{2}x_3 - \frac{1}{2}s_4$

$s_5 = 5 - 3x_1$

$x_1, x_2, x_3, s_1, s_2, s_3, s_4, s_5 \geq 0$

pivot on x_1

$\exists \; x_1 \leq \frac{11}{2}$

$\exists \; x_1 \leq 4$

$\exists \; x_1 \leq \frac{5}{3} \exists \; x_1 = \frac{5}{3} - \frac{1}{3}s_5$

$\exists \quad \max z = \frac{46}{3} - \frac{2}{3}s_5 - \frac{9}{2}x_3 - \frac{3}{2}s_4$

s.t.

$s_1 = \frac{23}{3} + \frac{2}{3}s_5 + \frac{3}{2}x_3 - \frac{1}{2}s_4$

$s_2 = 29 - 2s_5 - 6x_3 - 2s_4$

$s_3 = \frac{7}{3} + \frac{1}{3}s_5 + 2x_3$

$x_2 = \frac{17}{3} - \frac{1}{3}s_5 - \frac{1}{2}x_3 - \frac{1}{2}s_4$

$x_1 = \frac{5}{3} - \frac{1}{3}s_5$

$x_1, x_2, x_3, s_1, s_2, s_3, s_4, s_5 \geq 0$

$\therefore \boxed{\max z = \frac{46}{3}}$ #

$(x_1, x_2, x_3, s_1, s_2, s_3, s_4, s_5)$
$= (\frac{5}{3}, \frac{17}{3}, 0, \frac{23}{3}, 29, \frac{7}{3}, 0, 0)$

HW3-5

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$\max\{-x_0\}$, $\max z = 2x_1 + x_2$

s.t.

$s_1 = x_0 + 10 - x_1 - x_2$

$s_2 = x_0 - 2 - x_1 + x_2 \Rightarrow x_0 = 2 + s_2 + x_1 - x_2$

$x_0, x_1, x_2, s_1, s_2 \geq 0$

Before adding x_0

(x_1, x_2, s_1, s_2)

$= (0, 0, 10, -2)$

pivot on x_0

$\Rightarrow \max\{-2 - s_2 - x_1 + x_2\}$, $\max z = 2x_1 + x_2$

s.t. $s_1 = 12 + s_2 - 2x_2$

$x_0 = 2 + s_2 + x_1 - x_2 \Rightarrow x_2 = 2 - x_0 + x_1 + s_2$

$x_0, x_1, x_2, s_1, s_2 \geq 0$

pivot on x_2

$\Rightarrow \max\{-x_0\}$, $\max z = 2 - x_0 + 3x_1 + s_2$

s.t. $s_1 = 8 - x_0 - 2x_1 - s_2$

$x_2 = 2 + x_0 + x_1 + s_2$

$x_0, x_1, x_2, s_1, s_2 \geq 0$

$\because \max\{-x_0\} = 0$

set $x_0 = 0$ $\Rightarrow$ $\max z = 2 + 3x_1 + s_2$

s.t. $s_1 = 8 - 2x_1 - s_2$

$x_2 = 2 + x_1 + s_2$

$x_1, x_2, s_1, s_2 \geq 0$

pivot on x_1 $\Rightarrow x_1 = 4 - \frac{1}{2}s_1 - \frac{1}{2}s_2$

(x_1, x_2, s_1, s_2)

$= (0, 2, 8, 0)$

$\Rightarrow \max z = 14 - \frac{3}{2}s_1 - \frac{5}{2}s_2$

s.t. $x_1 = 4 - \frac{1}{2}s_1 - \frac{1}{2}s_2$

$x_2 = 6 - \frac{1}{2}s_1 + \frac{1}{2}s_2$

$x_1, x_2, s_1, s_2 \geq 0$

$\therefore \boxed{\max z = 14}$ //

(x_1, x_2, s_1, s_2)

$= (4, 6, 0, 0)$