

# Modelos de Computación.

## Práctica 4.

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### Resumen

Prácticas con el simulador URM.

## 1. Ejercicio 1

Computaciones para el programa

$J(2, 3, 0)$   
 $S(1)$   
 $S(3)$   
 $J(1, 1, 1)$

### 1.1. Computación para la entrada $R1 = 0, R2 = 0$

$$(1, < R1 = 0, R2 = 0, R3 = 0 >) \sim (0, < R1 = 0, R2 = 0, R3 = 0 >)$$

### 1.2. Computación para la entrada $R1 = 1, R2 = 1$

$$(1, < R1 = 1, R2 = 1, R3 = 0 >) \sim (2, < R1 = 1, R2 = 1, R3 = 0 >) \sim (3, < R1 = 2, R2 = 1, R3 = 0 >) \sim \\ (4, < R1 = 2, R2 = 1, R3 = 1 >) \sim (1, < R1 = 2, R2 = 1, R3 = 1 >) \sim (0, < R1 = 2, R2 = 1, R3 = 1 >)$$

### 1.3. Computación para la entrada $R1 = 1, R2 = 2$

$$(1, < R1 = 1, R2 = 2, R3 = 0 >) \sim (2, < R1 = 1, R2 = 2, R3 = 0 >) \sim (3, < R1 = 2, R2 = 2, R3 = 0 >) \sim \\ (4, < R1 = 2, R2 = 2, R3 = 1 >) \sim (1, < R1 = 2, R2 = 2, R3 = 1 >) \sim (2, < R1 = 2, R2 = 2, R3 = 1 >) \sim \\ (3, < R1 = 3, R2 = 2, R3 = 1 >) \sim (4, < R1 = 3, R2 = 2, R3 = 2 >) \sim (1, < R1 = 3, R2 = 2, R3 = 2 >) \sim \\ (0, < R1 = 3, R2 = 2, R3 = 2 >)$$

**1.4. Computación para la entrada  $R1 = 2, R2 = 1$** 

$$(1, < R1 = 2, R2 = 1, R3 = 0 >) \sim (2, < R1 = 2, R2 = 1, R3 = 0 >) \sim (3, < R1 = 3, R2 = 1, R3 = 0 >) \sim \\ (4, < R1 = 3, R2 = 1, R3 = 1 >) \sim (1, < R1 = 3, R2 = 1, R3 = 1 >) \sim (0, < R1 = 3, R2 = 1, R3 = 1 >)$$

**2. Ejercicio 2**

El programa

J (1, 2, 3)  
 J (1, 1, 4)  
 S (2)  
 T (2, 1)

calcula la función

$$f(x) = \begin{cases} x & \text{si } x > 0 \\ 1 & \text{en otro caso} \end{cases}$$

**3. Ejercicio 3**

Código propuesto para el programa "bloque de transferencia":

T (1, 2)  
 J (1, 1, 1)

**4. Ejercicio 4**

Computaciones para el programa

J (1, 4, 10)  
 T (1, 4)  
 S (2)  
 J (1, 2, 10)  
 Z (3)  
 S (3)  
 S (4)  
 J (1, 3, 3)  
 J (1, 1, 6)  
 T (4, 1)

**4.1. Computación para la entrada  $R1 = 0$** 

$$(1, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >) \sim (10, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >) \sim \\ (11, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >)$$

**4.2. Computación para la entrada  $R1 = 1$** 

$$\begin{aligned}
(1, < R1 = 1, R2 = 0, R3 = 0, R4 = 0 >) &\sim (2, < R1 = 1, R2 = 0, R3 = 0, R4 = 0 >) \sim \\
(3, < R1 = 1, R2 = 0, R3 = 0, R4 = 1 >) &\sim (4, < R1 = 1, R2 = 1, R3 = 0, R4 = 1 >) \sim \\
(10, < R1 = 1, R2 = 1, R3 = 0, R4 = 1 >) &\sim (11, < R1 = 1, R2 = 1, R3 = 0, R4 = 1 >)
\end{aligned}$$

**4.3. Computación para la entrada  $R1 = 2$** 

$$\begin{aligned}
(1, < R1 = 2, R2 = 0, R3 = 0, R4 = 0 >) &\sim (2, < R1 = 2, R2 = 0, R3 = 0, R4 = 0 >) \sim \\
(3, < R1 = 2, R2 = 0, R3 = 0, R4 = 2 >) &\sim (4, < R1 = 2, R2 = 1, R3 = 0, R4 = 2 >) \sim \\
(5, < R1 = 2, R2 = 1, R3 = 0, R4 = 2 >) &\sim (6, < R1 = 2, R2 = 1, R3 = 0, R4 = 2 >) \sim \\
(7, < R1 = 2, R2 = 1, R3 = 1, R4 = 2 >) &\sim (8, < R1 = 2, R2 = 1, R3 = 1, R4 = 3 >) \sim \\
(9, < R1 = 2, R2 = 1, R3 = 1, R4 = 3 >) &\sim (6, < R1 = 2, R2 = 1, R3 = 1, R4 = 3 >) \sim \\
(7, < R1 = 2, R2 = 1, R3 = 2, R4 = 3 >) &\sim (8, < R1 = 2, R2 = 1, R3 = 2, R4 = 4 >) \sim \\
(3, < R1 = 2, R2 = 1, R3 = 2, R4 = 4 >) &\sim (4, < R1 = 2, R2 = 2, R3 = 2, R4 = 4 >) \sim \\
(10, < R1 = 2, R2 = 2, R3 = 2, R4 = 4 >) &\sim (11, < R1 = 4, R2 = 2, R3 = 2, R4 = 4 >)
\end{aligned}$$

**4.4. Computación para la entrada  $R1 = 3$** 

$$\begin{aligned}
(1, < R1 = 3, R2 = 0, R3 = 0, R4 = 0 >) &\sim (2, < R1 = 3, R2 = 0, R3 = 0, R4 = 0 >) \sim \\
(3, < R1 = 3, R2 = 0, R3 = 0, R4 = 3 >) &\sim (4, < R1 = 3, R2 = 1, R3 = 0, R4 = 3 >) \sim \\
(5, < R1 = 3, R2 = 1, R3 = 0, R4 = 3 >) &\sim (6, < R1 = 3, R2 = 1, R3 = 0, R4 = 3 >) \sim \\
(7, < R1 = 3, R2 = 1, R3 = 1, R4 = 3 >) &\sim (8, < R1 = 3, R2 = 1, R3 = 1, R4 = 4 >) \sim \\
(9, < R1 = 3, R2 = 1, R3 = 1, R4 = 4 >) &\sim (6, < R1 = 3, R2 = 1, R3 = 1, R4 = 4 >) \sim \\
(7, < R1 = 3, R2 = 1, R3 = 2, R4 = 4 >) &\sim (8, < R1 = 3, R2 = 1, R3 = 2, R4 = 5 >) \sim \\
(9, < R1 = 3, R2 = 1, R3 = 2, R4 = 5 >) &\sim (6, < R1 = 3, R2 = 1, R3 = 2, R4 = 5 >) \sim \\
(7, < R1 = 3, R2 = 1, R3 = 3, R4 = 5 >) &\sim (8, < R1 = 3, R2 = 1, R3 = 3, R4 = 6 >) \sim \\
(3, < R1 = 3, R2 = 1, R3 = 3, R4 = 6 >) &\sim (4, < R1 = 3, R2 = 2, R3 = 3, R4 = 6 >) \sim \\
(5, < R1 = 3, R2 = 2, R3 = 3, R4 = 6 >) &\sim (6, < R1 = 3, R2 = 2, R3 = 0, R4 = 6 >) \sim \\
(7, < R1 = 3, R2 = 2, R3 = 1, R4 = 6 >) &\sim (8, < R1 = 3, R2 = 2, R3 = 1, R4 = 7 >) \sim \\
(9, < R1 = 3, R2 = 2, R3 = 1, R4 = 7 >) &\sim (6, < R1 = 3, R2 = 2, R3 = 1, R4 = 7 >) \sim \\
(7, < R1 = 3, R2 = 2, R3 = 2, R4 = 7 >) &\sim (8, < R1 = 3, R2 = 2, R3 = 2, R4 = 8 >) \sim \\
(9, < R1 = 3, R2 = 2, R3 = 2, R4 = 8 >) &\sim (6, < R1 = 3, R2 = 2, R3 = 2, R4 = 8 >) \sim \\
(7, < R1 = 3, R2 = 2, R3 = 3, R4 = 8 >) &\sim (8, < R1 = 3, R2 = 2, R3 = 3, R4 = 9 >) \sim \\
(3, < R1 = 3, R2 = 2, R3 = 3, R4 = 9 >) &\sim (4, < R1 = 3, R2 = 3, R3 = 3, R4 = 9 >) \sim \\
(10, < R1 = 3, R2 = 3, R3 = 3, R4 = 9 >) &\sim (11, < R1 = 9, R2 = 3, R3 = 3, R4 = 9 >)
\end{aligned}$$

**4.5. Función calculada**

El programa calcula la función

$$f(x) = x * x$$

## 5. Ejercicio 5

Computaciones para el programa

$J(2, 3, 5)$

$S(1)$

$S(3)$

$J(1, 1, 1)$

### 5.1. Computación para la entrada $R1 = 0, R2 = 0$

$$(1, \langle R1 = 0, R2 = 0, R3 = 0 \rangle) \sim (5, \langle R1 = 0, R2 = 0, R3 = 0 \rangle)$$

### 5.2. Computación para la entrada $R1 = 1, R2 = 0$

$$(1, \langle R1 = 1, R2 = 0, R3 = 0 \rangle) \sim (5, \langle R1 = 1, R2 = 0, R3 = 0 \rangle)$$

### 5.3. Computación para la entrada $R1 = 0, R2 = 1$

$$(1, \langle R1 = 0, R2 = 1, R3 = 0 \rangle) \sim (2, \langle R1 = 0, R2 = 1, R3 = 0 \rangle) \sim (3, \langle R1 = 1, R2 = 1, R3 = 0 \rangle) \sim (4, \langle R1 = 1, R2 = 1, R3 = 1 \rangle) \sim (1, \langle R1 = 1, R2 = 1, R3 = 1 \rangle) \sim (5, \langle R1 = 1, R2 = 1, R3 = 1 \rangle)$$

### 5.4. Computación para la entrada $R1 = 1, R2 = 1$

$$(1, \langle R1 = 1, R2 = 1, R3 = 0 \rangle) \sim (2, \langle R1 = 1, R2 = 1, R3 = 0 \rangle) \sim (3, \langle R1 = 2, R2 = 1, R3 = 0 \rangle) \sim (4, \langle R1 = 2, R2 = 1, R3 = 1 \rangle) \sim (1, \langle R1 = 2, R2 = 1, R3 = 1 \rangle) \sim (5, \langle R1 = 2, R2 = 1, R3 = 1 \rangle)$$

### 5.5. Función calculada

El programa calcula la función

$$f(x_1, x_2) = x_1 + x_2$$

## 6. Ejercicio 6

Computaciones para el programa

$J(1, 2, 6)$

$S(3)$

$S(2)$

$J(1, 1, 1)$

$Z(0)$

$J(1, 3, 10)$

$S(1)$

$J(1, 1, 7)$

**6.1. Computación para la entrada  $R1 = 0$** 

$$(1, < R1 = 0, R2 = 0, R3 = 0 >) \sim (6, < R1 = 0, R2 = 0, R3 = 0 >) \sim (9, < R1 = 0, R2 = 0, R3 = 0 >)$$

**6.2. Computación para la entrada  $R1 = 1$** 

$$(1, < R1 = 1, R2 = 0, R3 = 0 >) \sim (2, < R1 = 1, R2 = 0, R3 = 0 >) \sim (3, < R1 = 1, R2 = 0, R3 = 1 >) \sim \\ (4, < R1 = 1, R2 = 1, R3 = 1 >) \sim (1, < R1 = 1, R2 = 1, R3 = 1 >) \sim (6, < R1 = 1, R2 = 1, R3 = 1 >) \sim \\ (9, < R1 = 1, R2 = 1, R3 = 1 >)$$

**6.3. Computación para la entrada  $R1 = 2$** 

$$(1, < R1 = 2, R2 = 0, R3 = 0 >) \sim (2, < R1 = 2, R2 = 0, R3 = 0 >) \sim (3, < R1 = 2, R2 = 0, R3 = 1 >) \sim \\ (4, < R1 = 2, R2 = 1, R3 = 1 >) \sim (1, < R1 = 2, R2 = 1, R3 = 1 >) \sim (2, < R1 = 2, R2 = 1, R3 = 1 >) \sim \\ (3, < R1 = 2, R2 = 1, R3 = 2 >) \sim (4, < R1 = 2, R2 = 2, R3 = 2 >) \sim (1, < R1 = 2, R2 = 2, R3 = 2 >) \sim \\ (6, < R1 = 2, R2 = 2, R3 = 2 >) \sim (9, < R1 = 2, R2 = 2, R3 = 2 >)$$

**6.4. Computación para la entrada  $R1 = 3$** 

$$(1, < R1 = 3, R2 = 0, R3 = 0 >) \sim (2, < R1 = 3, R2 = 0, R3 = 0 >) \sim (3, < R1 = 3, R2 = 0, R3 = 1 >) \sim \\ (4, < R1 = 3, R2 = 1, R3 = 1 >) \sim (1, < R1 = 3, R2 = 1, R3 = 1 >) \sim (2, < R1 = 3, R2 = 1, R3 = 1 >) \sim \\ (3, < R1 = 3, R2 = 1, R3 = 2 >) \sim (4, < R1 = 3, R2 = 2, R3 = 2 >) \sim (1, < R1 = 3, R2 = 2, R3 = 2 >) \sim \\ (2, < R1 = 3, R2 = 2, R3 = 2 >) \sim (3, < R1 = 3, R2 = 2, R3 = 3 >) \sim (4, < R1 = 3, R2 = 3, R3 = 3 >) \sim \\ (1, < R1 = 3, R2 = 3, R3 = 3 >)(6, < R1 = 3, R2 = 3, R3 = 3 >) \sim (9, < R1 = 3, R2 = 3, R3 = 3 >)$$

**6.5. Función calculada**

El programa calcula la función

$$f(x) = x$$

**7. Ejercicio 7**

Computaciones para el programa

J (2, 3, 9)  
 J (1, 3, 9)  
 S (3)  
 S (4)  
 J (2, 4, 7)  
 J (1, 1, 2)  
 Z (4)  
 J (1, 1, 2)  
 T (4, 1)

**7.1. Computación para la entrada  $R1 = 0, R2 = 0$** 

$$(1, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >) \sim (9, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >) \sim (10, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >)$$

**7.2. Computación para la entrada  $R1 = 0, R2 = 1$** 

$$(1, < R1 = 0, R2 = 1, R3 = 0, R4 = 0 >) \sim (2, < R1 = 0, R2 = 1, R3 = 0, R4 = 0 >) \sim (9, < R1 = 0, R2 = 1, R3 = 0, R4 = 0 >) \sim (10, < R1 = 0, R2 = 1, R3 = 0, R4 = 0 >)$$

**7.3. Computación para la entrada  $R1 = 1, R2 = 0$** 

$$(1, < R1 = 1, R2 = 0, R3 = 0, R4 = 0 >) \sim (9, < R1 = 1, R2 = 0, R3 = 0, R4 = 0 >) \sim (10, < R1 = 0, R2 = 0, R3 = 0, R4 = 0 >)$$

**7.4. Computación para la entrada  $R1 = 1, R2 = 1$** 

$$(1, < R1 = 1, R2 = 1, R3 = 0, R4 = 0 >) \sim (2, < R1 = 1, R2 = 1, R3 = 0, R4 = 0 >) \sim (3, < R1 = 1, R2 = 1, R3 = 0, R4 = 0 >) \sim (4, < R1 = 1, R2 = 1, R3 = 1, R4 = 0 >) \sim (5, < R1 = 1, R2 = 1, R3 = 1, R4 = 1 >) \sim (7, < R1 = 1, R2 = 1, R3 = 1, R4 = 1 >) \sim (8, < R1 = 1, R2 = 1, R3 = 1, R4 = 0 >) \sim (2, < R1 = 1, R2 = 1, R3 = 1, R4 = 0 >) \sim (9, < R1 = 1, R2 = 1, R3 = 1, R4 = 0 >) \sim (10, < R1 = 0, R2 = 1, R3 = 1, R4 = 0 >)$$

**7.5. Función calculada**

El programa calcula la función

$$f(x_1, x_2) = \begin{cases} x_1 \text{ mód } x_2 & \text{si } x_2 > 0 \\ 0 & \text{en otro caso} \end{cases}$$

**8. Ejercicio 8**

Computaciones para el programa

T (1, 3)  
J (2, 3, 10)  
S (2)  
S (1)  
S (1)  
J (1, 1, 2)

**8.1. Computación para la entrada  $R1 = 0$** 

$$(1, < R1 = 0, R2 = 0, R3 = 0 >) \sim (2, < R1 = 0, R2 = 0, R3 = 0 >) \sim (7, < R1 = 0, R2 = 0, R3 = 0 >)$$

**8.2. Computación para la entrada  $R1 = 1$** 

$$\begin{aligned}
(1, < R1 = 1, R2 = 0, R3 = 0 >) \sim (2, < R1 = 1, R2 = 0, R3 = 1 >) \sim (3, < R1 = 1, R2 = 0, R3 = 1 >) \sim \\
(4, < R1 = 1, R2 = 1, R3 = 1 >) \sim (5, < R1 = 2, R2 = 1, R3 = 1 >) \sim (6, < R1 = 3, R2 = 1, R3 = 1 >) \sim \\
(2, < R1 = 3, R2 = 1, R3 = 1 >) \sim (7, < R1 = 3, R2 = 1, R3 = 1 >)
\end{aligned}$$

**8.3. Computación para la entrada  $R1 = 2$** 

$$\begin{aligned}
(1, < R1 = 2, R2 = 0, R3 = 0 >) \sim (2, < R1 = 2, R2 = 0, R3 = 2 >) \sim (3, < R1 = 2, R2 = 0, R3 = 2 >) \sim \\
(4, < R1 = 2, R2 = 1, R3 = 2 >) \sim (5, < R1 = 3, R2 = 1, R3 = 2 >) \sim (6, < R1 = 4, R2 = 1, R3 = 2 >) \sim \\
(2, < R1 = 4, R2 = 1, R3 = 2 >) \sim (3, < R1 = 4, R2 = 1, R3 = 2 >) \sim (4, < R1 = 4, R2 = 2, R3 = 2 >) \sim \\
(5, < R1 = 5, R2 = 2, R3 = 2 >) \sim (6, < R1 = 6, R2 = 2, R3 = 2 >) \sim (2, < R1 = 6, R2 = 2, R3 = 2 >) \sim \\
(7, < R1 = 6, R2 = 2, R3 = 2 >)
\end{aligned}$$

**8.4. Computación para la entrada  $R1 = 3$** 

$$\begin{aligned}
(1, < R1 = 3, R2 = 0, R3 = 0 >) \sim (2, < R1 = 3, R2 = 0, R3 = 3 >) \sim (3, < R1 = 3, R2 = 0, R3 = 3 >) \sim \\
(4, < R1 = 3, R2 = 1, R3 = 3 >) \sim (5, < R1 = 4, R2 = 1, R3 = 3 >) \sim (6, < R1 = 5, R2 = 1, R3 = 3 >) \sim \\
(2, < R1 = 5, R2 = 1, R3 = 3 >) \sim (3, < R1 = 5, R2 = 1, R3 = 3 >) \sim (4, < R1 = 5, R2 = 2, R3 = 3 >) \sim \\
(5, < R1 = 6, R2 = 2, R3 = 3 >) \sim (6, < R1 = 7, R2 = 2, R3 = 3 >) \sim (2, < R1 = 7, R2 = 2, R3 = 3 >) \sim \\
(3, < R1 = 7, R2 = 2, R3 = 3 >) \sim (4, < R1 = 7, R2 = 3, R3 = 3 >) \sim (5, < R1 = 8, R2 = 3, R3 = 3 >) \sim \\
(6, < R1 = 9, R2 = 3, R3 = 3 >) \sim (2, < R1 = 9, R2 = 3, R3 = 3 >) \sim (7, < R1 = 9, R2 = 3, R3 = 3 >)
\end{aligned}$$

**8.5. Función calculada**

El programa calcula la función

$$f(x) = 3x$$