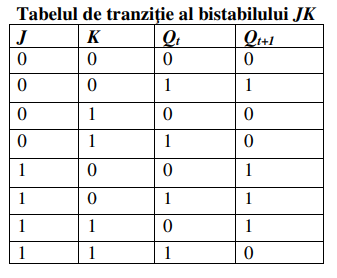
1. **Sinteza Registrului de deplasare stânga ciclică, pe 4 biți, în baza bistabilelor JK**

**Tabelul de tranziție al bistabilului JK:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | J | K |
| 0 | 0 | 0 | \* |
| 0 | 1 | 1 | \* |
| 1 | 0 | \* | 1 |
| 1 | 1 | \* | 0 |

****

1. **Elaborarea Tabelului de tranziție al registrului de deplasare:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **t** | | | | **t+1** | | | | **t+1** | | | | | | | | |
|  | Q3 | Q2 | Q1 | Q0 | Q3 | Q2 | Q1 | Q0 | J3 | K3 | J2 | K2 | J1 | K1 | J0 | K0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \* | 0 | \* | 0 | \* | 0 | \* |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | \* | 0 | \* | 1 | \* | \* | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | \* | 1 | \* | \* | 1 | 0 | \* |
| 3 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | \* | 1 | \* | \* | 0 | \* | 1 |
| 4 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | \* | \* | 1 | 0 | \* | 0 | \* |
| 5 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | \* | \* | 1 | 1 | \* | \* | 1 |
| 6 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | \* | \* | 0 | \* | 1 | 0 | \* |
| 7 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | \* | \* | 0 | \* | 0 | \* | 1 |
| 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | \* | 1 | 0 | \* | 0 | \* | 1 | \* |
| 9 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | \* | 1 | 0 | \* | 1 | \* | \* | 0 |
| 10 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | \* | 1 | 1 | \* | \* | 1 | 1 | \* |
| 11 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | \* | 1 | 1 | \* | \* | 0 | \* | 0 |
| 12 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | \* | 0 | \* | 1 | 0 | \* | 1 | \* |
| 13 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | \* | 0 | \* | 1 | 1 | \* | \* | 0 |
| 14 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | \* | 0 | \* | 0 | \* | 1 | 1 | \* |
| 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | \* | 0 | \* | 0 | \* | 0 | \* | 0 |

1. **Minimizea funcțiilor**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  | 1 | \* | \* |
| 01 |  | 1 | \* | \* |
| 11 |  | 1 | \* | \* |
| 10 |  | 1 | \* | \* |

**J3**

**Q2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 | \* | \* |  | 1 |
| 01 | \* | \* |  | 1 |
| 11 | \* | \* |  | 1 |
| 10 | \* | \* |  | 1 |

**K3**

**K3=Q2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  | \* | \* |  |
| 01 |  | \* | \* |  |
| 11 | 1 | \* | \* | 1 |
| 10 | 1 | \* | \* | 1 |

**J2**

**J2=Q1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 | \* | 1 | 1 | \* |
| 01 | \* | 1 | 1 | \* |
| 11 | \* |  |  | \* |
| 10 | \* |  |  | \* |

**K2**

**K2=**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 | 1 | 1 | 1 | 1 |
| 11 | \* | \* | \* | \* |
| 10 | \* | \* | \* | \* |

**J1**

**J1=Q0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 | \* | \* | \* | \* |
| 01 | \* | \* | \* | \* |
| 11 |  |  |  |  |
| 10 | 1 | 1 | 1 | 1 |

**K1**

**K1=**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  | 1 | 1 |
| 01 | \* | \* | \* | \* |
| 11 | \* | \* | \* | \* |
| 10 |  |  | 1 | 1 |

**J0**

**J0=Q3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 | \* | \* | \* | \* |
| 01 | 1 | 1 |  |  |
| 11 | 1 | 1 |  |  |
| 10 | \* | \* | \* | \* |

**K0**

**K0=**

1. **Implementarea Circuitului Logic:**

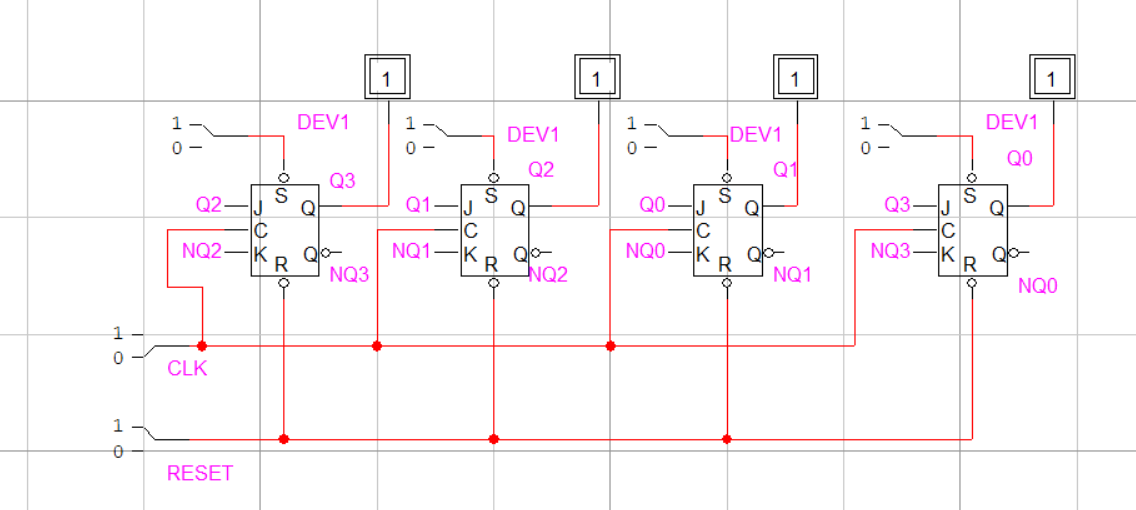
**Q2 K3=**

**J2=Q1 K2=** **J1=Q0**

**K1=**

**J0=Q3**

**K0=**



**II) Sinteza Registrului de deplasare *dreapta* ciclică, pe 4 biți, în baza bistabilelor *SR***

**Tabelul de tranziție al bistabilului SR:**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | S | R |
| 0 | 0 | 0 | \* |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | \* | 0 |

1. **Elaborarea Tabelului de tranziție:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **t** | | | | **t+1** | | | | **t+1** | | | | | | | | |
|  | Q3 | Q2 | Q1 | Q0 | Q3 | Q2 | Q1 | Q0 | S3 | R3 | S2 | R2 | S1 | R1 | S0 | R0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \* | 0 | \* | 0 | \* | 0 | \* |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | \* | 0 | \* | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | \* | 0 | \* | 0 | 1 | 1 | 0 |
| 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | \* | 0 | 1 | \* | 0 |
| 4 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | \* | 0 | 1 | 1 | 0 | 0 | \* |
| 5 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 6 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | \* | 0 | 1 | \* | 0 | 1 | 0 |
| 7 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | \* | 0 | \* | 0 |
| 8 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | \* | 0 | \* |
| 9 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | \* | 0 | 1 | 0 | 0 | \* | 0 | 1 |
| 10 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| 11 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | \* | 0 | 1 | 0 | 0 | 1 | \* | 0 |
| 12 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | \* | 0 | 1 | 0 | 0 | \* |
| 13 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | \* | 0 | \* | 0 | 1 | 0 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | \* | 0 | \* | 0 | 1 | 0 |
| 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | \* | 0 | \* | 0 | \* | 0 | \* | 0 |

**3. Minimiarea funcțiilor**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 | 1 | 1 | \* | \* |
| 11 | 1 | 1 | \* | \* |
| 10 |  |  |  |  |

**S3**

**Q1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 | \* | \* | 1 | 1 |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 | \* | \* | 1 | 1 |

**R3**

**R3=**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**S2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**R2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**S1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**R1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**S0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q3Q2  Q1Q0 | 00 | 01 | 11 | 10 |
| 00 |  |  |  |  |
| 01 |  |  |  |  |
| 11 |  |  |  |  |
| 10 |  |  |  |  |

**R0**

1. **Implementarea Circuitului Logic:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **t** |  |  |  | **t+1** |  |  | **t+1** | | | | | | | |
|  | **X** | Q3 | Q2 | Q1 | Q0 | Q3 | Q2 | Q1 | Q0 | J3 | K3 | J2 | K2 | J1 | K1 | J0 | K0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \* |  |  |  |  |  |  |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | \* |  |  |  |  |  |  |
| 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | \* |  |  |  |  |  |  |
| 3 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | \* |  |  |  |  |  |  |
| 4 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | \* |  |  |  |  |  |  |
| 5 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | \* |  |  |  |  |  |  |
| 6 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | \* |  |  |  |  |  |  |
| 7 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | \* |  |  |  |  |  |  |
| 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | \* | 1 |  |  |  |  |  |  |
| 9 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | \* | 1 |  |  |  |  |  |  |
| 10 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | \* | 1 |  |  |  |  |  |  |
| 11 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | \* | 1 |  |  |  |  |  |  |
| 12 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | \* | 0 |  |  |  |  |  |  |
| 13 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | \* | 0 |  |  |  |  |  |  |
| 14 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | \* | 0 |  |  |  |  |  |  |
| 15 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | \* | 0 |  |  |  |  |  |  |
| 16 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | **\*** |  |  |  |  |  |  |
| 17 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | **1** | **\*** |  |  |  |  |  |  |
| 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | **0** | **\*** |  |  |  |  |  |  |
| 19 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | **1** | **\*** |  |  |  |  |  |  |
| 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | **0** | **\*** |  |  |  |  |  |  |
| 21 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | **1** | **\*** |  |  |  |  |  |  |
| 22 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | **0** | **\*** |  |  |  |  |  |  |
| 23 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | **1** | **\*** |  |  |  |  |  |  |
| 24 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | **\*** | **1** |  |  |  |  |  |  |
| 25 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | **\*** | **0** |  |  |  |  |  |  |
| 26 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | **\*** | **1** |  |  |  |  |  |  |
| 27 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | **\*** | **0** |  |  |  |  |  |  |
| 28 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | **\*** | **1** |  |  |  |  |  |  |
| 29 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | **\*** | **0** |  |  |  |  |  |  |
| 30 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | **\*** | **1** |  |  |  |  |  |  |
| 31 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **\*** | **0** |  |  |  |  |  |  |

**III) Sinteza Registrului de deplasare bidirecțională ciclică, pe 4 biți, în baza bistabilelor JK:**

**PENTRU X=0 – DEPLASAREA STÂNGA**

**X=1 -DEPLASAREA DREAPTA**

1. **Elaborarea Tabelului de tranziție:**

1. **Minimizarea funcțiilor:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xQ3Q2  Q1Q0 | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
| 00 | 0 | 4 | 12 | 8 | 24 | 28 | 20 | 16 |
| 01 | 1 | 5 | 13 | 9 | 25 | 29 | 21 | 17 |
| 11 | 3 | 7 | 15 | 11 | 27 | 31 | 23 | 19 |
| 10 | 2 | 6 | 14 | 10 | 26 | 30 | 22 | 18 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xQ3Q2  Q1Q0 | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 |
| 00 |  | 1 | \* | \* | \* | \* |  |  |
| 01 |  | 1 | \* | \* | \* | \* | 1 | 1 |
| 11 |  | 1 | \* | \* | \* | \* | 1 | 1 |
| 10 |  | 1 | \* | \* | \* | \* |  |  |

**J3=**

**3. Implementarea Circuitului Logic:**