## 14-STATE STATE MACHINE

| State (Dec) | State (Bin) | A | B | C | D | E = 1(Dec) | E = 1(Bin) | Q0 | Q1 | Q2 | Q3 | E = 0(Dec) | E = 0(Bin) | D0 | D1 | D2 | D3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0000 | 0 | 0 | 0 | 0 | 1 | 0001 | 0 | 0 | 0 | 1 | 8 | 1000 | 1 | 0 | 0 | 0 |
| 1 | 0001 | 0 | 0 | 0 | 1 | 3 | 0011 | 0 | 0 | 1 | 1 | 0 | 0000 | 0 | 0 | 0 | 0 |
| 2 | 0010 | 0 | 0 | 1 | 0 | 6 | 0110 | 0 | 1 | 1 | 0 | 3 | 0011 | 0 | 0 | 1 | 1 |
| 3 | 0011 | 0 | 0 | 1 | 1 | 2 | 0010 | 0 | 0 | 1 | 0 | 1 | 0001 | 0 | 0 | 0 | 1 |
| 4 | 0100 | 0 | 1 | 0 | 0 | x | xxxx | x | x | x | x | x | xxxx | x | x | x | x |
| 5 | 0101 | 0 | 1 | 0 | 1 | 13 | 1101 | 1 | 1 | 0 | 1 | 7 | 0111 | 0 | 1 | 1 | 1 |
| 6 | 0110 | 0 | 1 | 1 | 0 | 7 | 0111 | 0 | 1 | 1 | 1 | 2 | 0010 | 0 | 0 | 1 | 0 |
| 7 | 0111 | 0 | 1 | 1 | 1 | 5 | 0101 | 0 | 1 | 0 | 1 | 6 | 0110 | 0 | 1 | 1 | 0 |
| 8 | 1000 | 1 | 0 | 0 | 0 | 0 | 0000 | 0 | 0 | 0 | 0 | 9 | 1001 | 1 | 0 | 0 | 1 |
| 9 | 1001 | 1 | 0 | 0 | 1 | 8 | 1000 | 1 | 0 | 0 | 0 | 11 | 1011 | 1 | 0 | 1 | 1 |
| 10 | 1010 | 1 | 0 | 1 | 0 | 11 | 1011 | 1 | 0 | 1 | 1 | 14 | 1110 | 1 | 1 | 1 | 0 |
| 11 | 1011 | 1 | 0 | 1 | 1 | 9 | 1001 | 1 | 0 | 0 | 1 | 10 | 1010 | 1 | 0 | 1 | 0 |
| 12 | 1100 | 1 | 1 | 0 | 0 | x | xxxx | x | x | x | x | x | xxxx | x | x | x | x |
| 13 | 1101 | 1 | 1 | 0 | 1 | 15 | 1111 | 1 | 1 | 1 | 1 | 5 | 0101 | 0 | 1 | 0 | 1 |
| 14 | 1110 | 1 | 1 | 1 | 0 | 10 | 1010 | 1 | 0 | 1 | 0 | 15 | 1111 | 1 | 1 | 1 | 1 |
| 15 | 1111 | 1 | 1 | 1 | 1 | 14 | 1110 | 1 | 1 | 1 | 0 | 13 | 1101 | 1 | 1 | 0 | 1 |

## Gray code

| Gray code (Bin) | Gray code (Dec) |
|---|---|
| 0000 | 00 |
| 0001 | 01 |
| 0011 | 03 |
| 0010 | 02 |
| 0110 | 06 |
| 0111 | 07 |
| 0101 | 05 |
| 1101 | 13 |
| 1111 | 15 |
| 1110 | 14 |
| 1010 | 10 |
| 1011 | 11 |
| 1001 | 09 |
| 1000 | 08 |

AB \ CD

**(E = 1)**  **(E = 0)**

### Q0

| Q0 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 0 |
| 01 | x | 1 | 0 | 0 |
| 11 | x | 1 | 1 | 1 |
| 10 | 0 | 1 | 1 | 1 |

### D0

| D0 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 0 | 0 | 0 |
| 01 | x | 0 | 0 | 0 |
| 11 | x | 0 | 1 | 1 |
| 10 | 1 | 1 | 1 | 1 |

### EDCBA

| |
|---|
| xx1x1 |
| 0xx01 |
| 000xx |
| 1x01x |
| x1001 |

### Q1

| Q1 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 1 |
| 01 | x | 1 | 1 | 1 |
| 11 | x | 1 | 1 | 0 |
| 10 | 0 | 0 | 0 | 0 |

### D1

| D1 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 0 |
| 01 | x | 1 | 0 | 1 |
| 11 | x | 1 | 1 | 1 |
| 10 | 0 | 0 | 0 | 1 |

| |
|---|
| 0xx11 |
| 001x1 |
| 1111x |
| xx01x |
| 101x0 |
| 0011x |

### Q2

| Q2 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 1 | 1 | 1 |
| 01 | x | 0 | 1 | 0 |
| 11 | x | 1 | 1 | 1 |
| 10 | 0 | 0 | 0 | 1 |

### D2

| D2 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 1 |
| 01 | x | 1 | 1 | 1 |
| 11 | x | 0 | 0 | 1 |
| 10 | 0 | 1 | 1 | 1 |

| |
|---|
| 001xx |
| 1xx11 |
| 01x01 |
| 0xx10 |
| 101x1 |
| 111x0 |
| 1x100 |
| 11x00 |

### Q3

| Q3 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 1 | 0 | 0 |
| 01 | x | 1 | 1 | 1 |
| 11 | x | 1 | 0 | 0 |
| 10 | 0 | 0 | 1 | 1 |

### D3

| D3 | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 1 | 1 |
| 01 | x | 1 | 0 | 0 |
| 11 | x | 1 | 1 | 1 |
| 10 | 1 | 1 | 0 | 0 |

| |
|---|
| xx01x |
| 0x100 |
| 1x101 |
| 0x0x1 |
| 0xx11 |
| 1x0x0 |
| 1xx10 |