CS221 HW5 Quan Nguyen

Follow the steps to build a dual-mode 3-bit counter with one input bit, M. When M is 0, the counter is a normal mod-8 counter. When M is 1, the counter follows the 3-bit Gray Code sequence. The counter advances with every tick of the clock

1. Draw a state transition diagram for the counter. Label each state with it's 3-bit binary representation

| Label | Normal Binary |
| --- | --- |
| 0\_n | 000 |
| 1\_n | 001 |
| 2\_n | 010 |
| 3\_n | 011 |
| 4\_n | 100 |
| 5\_n | 101 |
| 6\_n | 110 |
| 7\_n | 111 |

| Label | Gray Code |
| --- | --- |
| 0\_g | 000 |
| 1\_g | 001 |
| 2\_g | 011 |
| 3\_g | 010 |
| 4\_g | 110 |
| 5\_g | 111 |
| 6\_g | 101 |
| 7\_g | 100 |

| M | Current state | Next state |
| --- | --- | --- |
| 0 | 0\_n | 1\_n |
| 0 | 1\_n | 2\_n |
| 0 | 2\_n | 3\_n |
| 0 | 3\_n | 4\_n |
| 0 | 4\_n | 5\_n |
| 0 | 5\_n | 6\_n |
| 0 | 6\_n | 7\_n |
| 0 | 7\_n | 0\_n |
| 1 | 0\_g | 1\_g |
| 1 | 1\_g | 2\_g |
| 1 | 2\_g | 3\_g |
| 1 | 3\_g | 4\_g |
| 1 | 4\_g | 5\_g |
| 1 | 5\_g | 6\_g |
| 1 | 6\_g | 7\_g |
| 1 | 7\_g | 0\_g |



1. Construct a truth table mapping the input M and current state to the next state

| Num | M | c\_2 | c\_1 | c\_0 | n\_2 | n\_1 | n\_0 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 2 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 4 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 5 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 7 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 8 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 10 | 1 | 0 | 1 | 1 | 0 | 1 | 0 |
| 11 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| 12 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 13 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| 14 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 15 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |