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**INDIVIDUAL TASKS:**

**2.** Following are non-valid BCD encodings for the decimal digits:

* 1010
* 1011
* 1100
* 1101
* 1111

|  |  |
| --- | --- |
| State | Description |
| *S0* | *The 3 most recent bits are x00* |
| *S1* | *The 3 most recent bits are 001* |
| *S2* | *The 3 most recent bits are 010* |
| *S3* | *The 3 most recent bits are 011* |
| *S4* | *The 3 most recent bits are 101* |
| *S5* | *The 3 most recent bits are 110* |
| *S6* | *The 3 most recent bits are 111* |

The state machines would need to detect when the significant bits would be 101 or 11. The table below would define the states.

*Table 1*

I’ll use the states defined above and obtain the *Next State (N.S)* and the *Output (Z)* for the *Present State* and the *Input (X).*

Consider the *present state* as *S0*,

If the input is 1, then the *next state* is *S1* and the output is *Z = 0*.

If the input is 0, then the *next state* is *S0*and the output is *Z = 0.*

Consider the *present state* as *S1*,

If the input is 1, then the *next state* is *S3* and the output is *Z = 0.*

If the input is 1, then the *next state* is *S2* and the output is *Z = 0.*

Consider the *present state* as *S2*,

If the input is 1, then the *next state* is *S4* and the output is *Z = 0.*

If the input is 1, then the *next state* is *S0* and the output is *Z = 0.*

Consider the *present state* as *S3*,

If the input is 1, then the *next state* is *S6* and the output is *Z = 0.*

If the input is 1, then the *next state* is *S5* and the output is *Z = 0.*

Consider the *present state* as *S4*,

If the input is 1, then the *next state* is *S3* and the output is *Z = 1.*

If the input is 1, then the *next state* is *S2* and the output is *Z = 1.*

Consider the *present state* as *S5*,

If the input is 1, then the *next state* is *S4* and the output is *Z = 1.*

If the input is 1, then the *next state* is *S0* and the output is *Z = 1.*

Consider the *present state* as *S6*,

If the input is 1, then the *next state* is *S6* and the output is *Z = 1.*

If the input is 1, then the *next state* is *S5* and the output is *Z = 1.*

Using the explanation, below is the state table for the *Mealy Sequential circuit*:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Present State* | *Next State* | | | *Output* | |
|  | *X = 0*  *X = 1* | | | *X = 0*  *X =1* | |
| *S0* | *S1* | *S1* | 0 | | 0 |
| *S1* | *S2* | *S3* | 0 | | 0 |
| *S2* | *S0* | *S4* | 0 | | 0 |
| *S3* | *S5* | *S6* | 0 | | 0 |
| *S4* | *S2* | *S3* | 1 | | 1 |
| *S5* | *S0* | *S4* | 1 | | 1 |
| *S6* | *S5* | *S6* | 1 | | 1 |