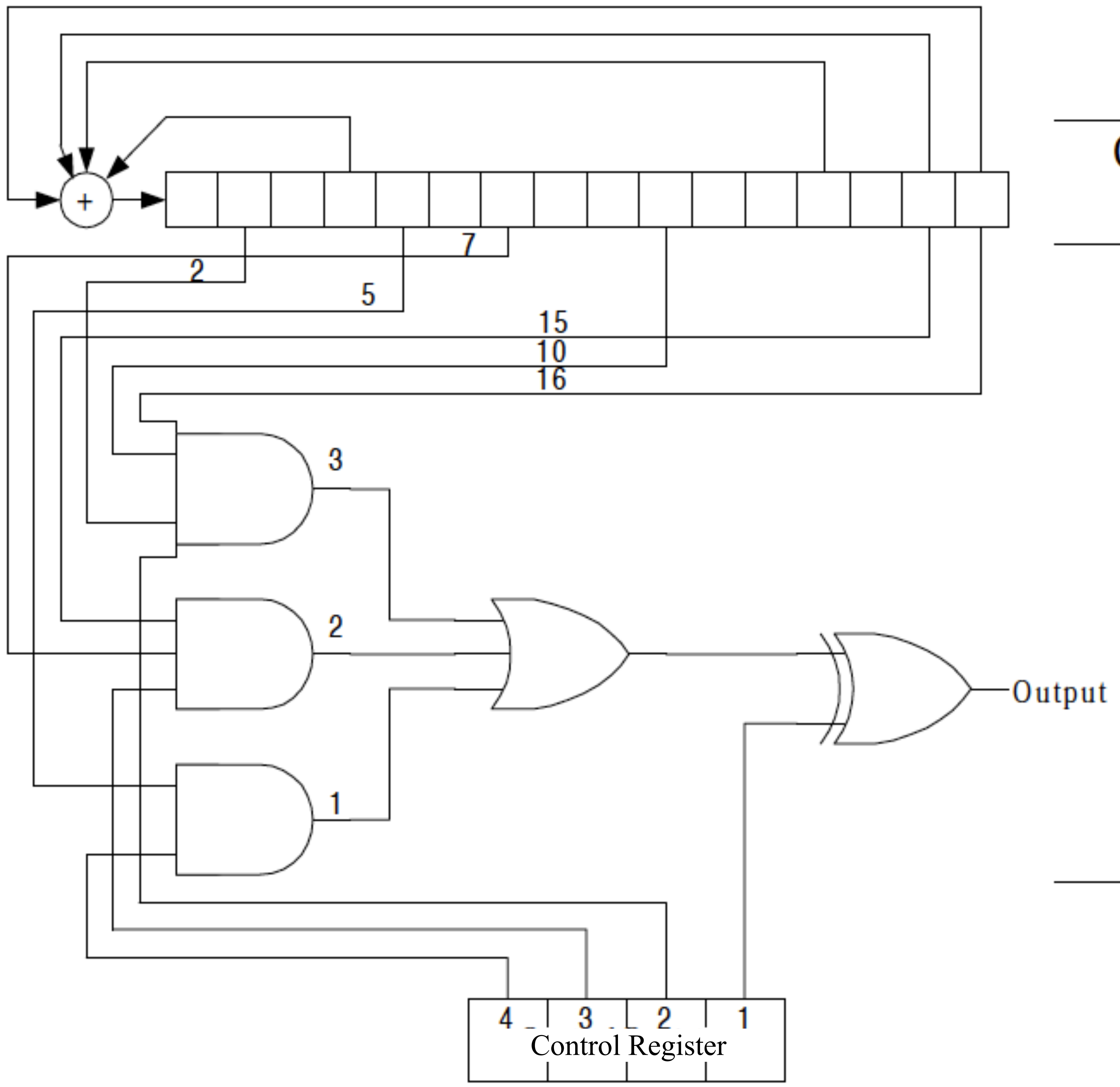
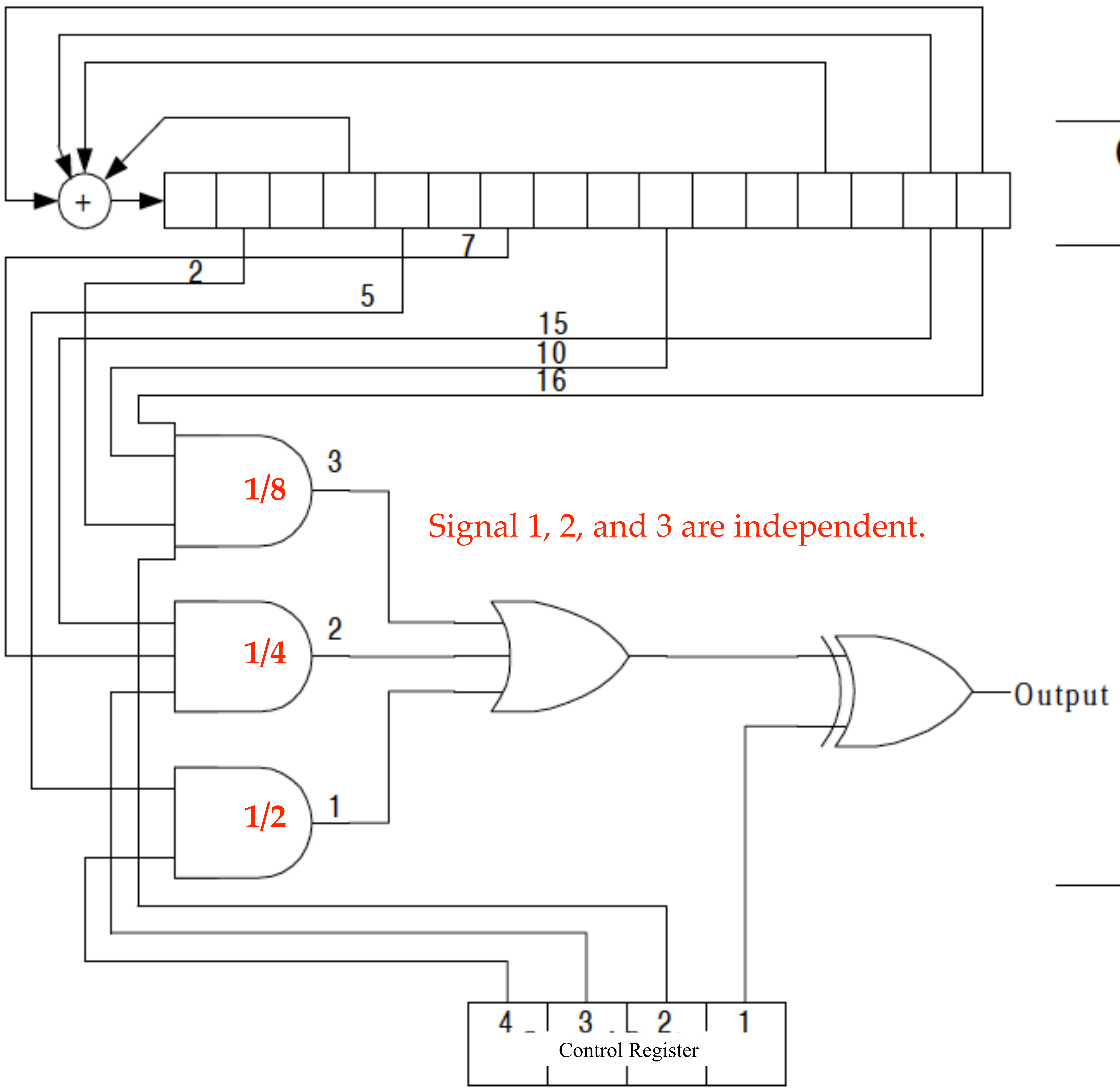
# HW 02-1 Weighted Random Pattern Generation

- Complete the RHS table of the following table and explain how the signal probabilities are derived for all control register states.

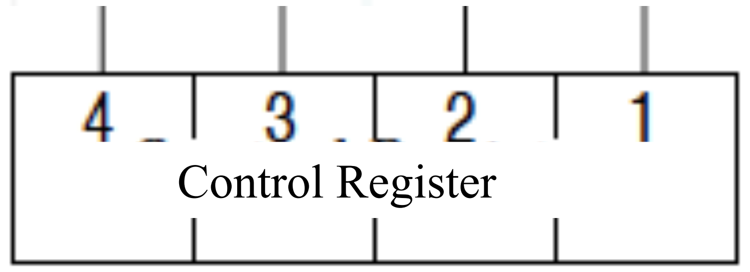



| Control Register State | Approximate Signal Probability |
|---|---|
| 1000 | .5 |
| 0100 | .25 |
| 0010 | .125 |
| 0101 | .75 |
| 0011 | .875 |
| 1100 | .625 |
| 1010 | .5625 |
| 0110 | .3437 |
| . | |
| . | |
| . | |




if 1, 1/2 1/4 1/8

| state | | | |
|---|---|---|---|
| 4321 | 1234 | prob. 1 | |
| 0000 | 0000 | 0 | |
| 1000 | 0001 | 0.5 | 1/2 |
| 0100 | 0010 | 0.25 | 1/4 |
| 1100 | 0011 | 0.625 | 1 − (3/4 ∗ 1/2) |
| 0010 | 0100 | 0.125 | 1/8 |
| 1010 | 0101 | 0.5625 | 1 − (7/8 ∗ 1/2) |
| 0110 | 0110 | 0.34375 | 1 − (7/8 ∗ 3/4) |
| 1110 | 0111 | 0.671875 | 1 − (7/8 ∗ 3/4 ∗ 1/2) |
| 1000 | 1000 | 1 | |
| 1001 | 1001 | 0.5 | 1 − 1/2 |
| 0101 | 1010 | 0.75 | 1 − 1/4 |
| 1101 | 1011 | 0.375 | 3/4 ∗ 1/2 |
| 0011 | 1100 | 0.875 | 1 − 1/8 |
| 0111 | 1101 | 0.4375 | 7/8 ∗ 1/2 |
| 0111 | 1110 | 0.65625 | 7/8 ∗ 3/4 |
| 1111 | 1111 | 0.328125 | |
| | | 4.921875 | |




| state | | |
|---|---|---|
| 1234 | prob. 1 | |
| 0000 | 0 | |
| 0001 | 0.5 | 1/2 |
| 0010 | 0.25 | 1/4 |
| 0011 | 0.625 | 1 − (3/4 ∗ 1/2) |
| 0100 | 0.125 | 1/8 |
| 0101 | 0.5625 | 1 − (7/8 ∗ 1/2) |
| 0110 | 0.34375 | 1 − (7/8 ∗ 3/4) |
| 0111 | 0.671875 | 1 − (7/8 ∗ 3/4 ∗ 1/2) |
| 1000 | 1 | |
| 1001 | 0.5 | 1 − 1/2 |
| 1010 | 0.75 | 1 − 1/4 |
| 1011 | 0.375 | 3/4 ∗ 1/2 |
| 1100 | 0.875 | 1 − 1/8 |
| 1101 | 0.4375 | 7/8 ∗ 1/2 |
| 1110 | 0.65625 | 7/8 ∗ 3/4 |
| 1111 | 0.328125 | |

| state | | |
|---|---|---|
| 4321 | prob. 1 | |
| 0000 | 0 | |
| 0001 | 1 | |
| 0010 | 0.125 | 1/8 |
| 0011 | 0.875 | 1 − 1/8 |
| 0100 | 0.25 | 1/4 |
| 0101 | 0.75 | 1 − 1/4 |
| 0110 | 0.34375 | 1 − (7/8 ∗ 3/4) |
| 0111 | 0.65625 | 7/8 ∗ 3/4 |
| 1000 | 0.5 | 1/2 |
| 1001 | 0.5 | 1 − 1/2 |
| 1010 | 0.5625 | 1 − (7/8 ∗ 1/2) |
| 1011 | 0.4375 | 7/8 ∗ 1/2 |
| 1100 | 0.625 | 1 − (3/4 ∗ 1/2) |
| 1101 | 0.375 | 3/4 ∗ 1/2 |
| 1110 | 0.671875 | 1 − (7/8 ∗ 3/4 ∗ 1/2) |
| 1111 | 0.328125 | |

# HW 02-2 Aliasing Probability

- Derive the aliasing probabilities of SISR and MISR.

- Solution for SISR:
  - Assume (1) an $n$-bit SISR and an $L$-bit sequence, and (2) the $2^L$ patterns are uniformly mapped to the $2^n$ possible signatures.
  - The number of faulty patterns is $2^L - 1$.
  - The number of patterns mapped to the good signature is $2^L \cdot \dfrac{1}{2^n} = 2^{L-n}$, out of which one is the fault-free pattern.
  - Aliasing probability $= \dfrac{2^{L-n} - 1}{2^L - 1} \approx 2^{-n}$ if $L \gg n$.

- Solution for MISR:
  - Assume (1) an $n$-bit MISR and $m$ $L$-bit sequences, and (2) the $2^{mL}$ patterns are uniformly mapped to the $2^n$ possible signatures.
  - The number of faulty patterns is $2^{mL} - 1$.
  - The number of patterns mapped to the good signature is $2^{mL} \cdot \frac{1}{2^n} = 2^{mL-n}$, out of which one is the fault-free pattern.
  - Aliasing probability $= \dfrac{2^{mL-n} - 1}{2^{mL} - 1} \approx 2^{-n}$ if $L \gg n$.