

- [7] The following is an **SR-FF circuit** using **NAND** gate. Complete the **State transition table**. [8 pts]
If the state is invalid, write '**Invalid state**'.

Set	Reset	Q (Current)	Q (Next)
0	0	0	Invalid state
0	0	1	Invalid state
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

- [8] An audio CD stores **650 MB** (MegaBytes) of data. The sampling rate of **44 kHz** is used with **16-bit** quantization. What duration of **stereo music (two separate waveforms)** can be stored on a CD? Give the answer in **minutes**. You must show your calculation process. [5 pts]

650 MB, $f_s = 44 \cdot 10^3 \text{ Hz}$, 16 bit quantization.
 $= 8 \times 650 \times 10^3 \text{ bits}$ $= 44 \cdot 10^3 \text{ sample/sec}$

$$T_s = \frac{1}{44 \cdot 10^3} \text{ s} = \frac{1}{44} \text{ ms. or } 22.7 \mu\text{s}$$

$8 \times 650 \times 10^3 \cdot 16 \text{ bit} = 83.2 \text{ Mbits}$
 $83.2 \text{ Mbits} = 3660 \text{ Gbits}$ $83.2 \text{ Mbits} \times \frac{1}{44} \text{ ms} = 83.2 \times 10^6 \times \frac{1}{44} \times 10^{-3} = 1.89 \text{ Gbits}$

- [9] The following figure depicts the noise/distortion chain in digital communication. Specify possible types of noise or distortion (a) in sensors acquiring an analog signal, (b) in the analog-to-digital conversion process, (c) in wireless data transmission. [6 pts]

