

Test case 6

A, (2), -13-, (3), -14-, (4), -16-, (7)

XOR (2)

$$\begin{aligned}\text{input trans} &= 0.5 \\ \text{output cap} &= 0.0178 + 0.18 = 0.1978 \\ \text{delay} &= 0.807 \\ \text{output trans} &= 0.8976\end{aligned}$$

AND (3)

$$\begin{aligned}\text{input trans} &= 0.8976 \\ \text{output cap} &= 0.06 \times 2 + 0.0435 + 0.0405 = 0.204 \\ \text{delay} &= 0.196 \\ \text{output trans} &= 0.201\end{aligned}$$

XOR (4)

$$\begin{aligned}\text{input trans} &= 0.201 \\ \text{output cap} &= 0.06 + 0.0405 = 0.1005 \\ \text{delay} &= 0.165 \\ \text{output trans} &= 0.203\end{aligned}$$

FF (7)

$$\begin{aligned}\text{input trans} &= 0.203 \\ \text{output cap} &= 0.1 \\ \text{setup time} &= 0.042, T_{cq} = 0.236\end{aligned}$$

A, (2), -13-, (3), -14-, (6)

FF (6)

$$\begin{aligned}\text{input trans} &= 0.201 \\ \text{output cap} &= 0.06 + 0.06 = 0.12 \\ \text{setup time} &= 0.0613 \\ T_{cq} &= 0.275 \\ \text{output trans} &= 0.212\end{aligned}$$

B, (1), -10-, (5)

NOR (1)

$$\begin{aligned}\text{input trans} &= 0.5 \\ \text{output cap} &= 0.06 + 0.0405 = 0.1005 \\ \text{delay} &= 0.404 \\ \text{output trans} &= 0.454\end{aligned}$$

FF (5)

$$\begin{aligned}\text{input trans} &= 0.454 \\ \text{output cap} &= 0.06 + 0.0435 = 0.1035 \\ \text{setup time} &= 0.099 \\ T_{cq} &= 0.3034 \\ \text{output trans} &= 0.2236\end{aligned}$$

C, ①, -10-, ⑤

NOR(1) input trans = 0.5
output cap = 0.1005
delay = 0.421
output trans = 0.446

FF(5) input trans = 0.446
output cap = 0.1035
setup time = 0.0976
 $T_{cq} = 0.298$
output trans = 0.2203

C, ③, -14-, ⑥

AND(3) input trans = 0.5
output cap = 0.204
delay = 0.648
output trans = 0.784

FF(6) input trans = 0.784
output cap = $0.06 \times 2 = 0.12$
setup time = 0.029
 $T_{cq} = 0.236$
output trans = 0.177

C, ③, -14-, ④, -16-, ⑦

XOR(4) input trans = 0.784
output cap = 0.1005
delay = 0.083
output trans = 0.097

FF(7) input trans = 0.097
output cap = 0.1
setup time = 0.0524

⑤, -12-, ②, -13-, ③, -14-, ④, -16-, ⑦

XOR(2)

input trans = 0.223
output cap = 0.1978
delay = 0.336
output trans = 0.455

AND(3)

input trans = 0.445
output cap = 0.204
delay = 0.630
output trans = 0.725

XOR(4)

input trans = 0.725
output cap = 0.1005
delay = 0.073
output trans = 0.089

FF(7)

input trans = 0.089
output cap = 0.1
setup time = 0.048

⑤, -12-, ②, -13-, ③, -14-, ⑥

FF(6)

input trans = 0.725
output cap = 0.12
setup time = 0.025
 $T_{cq} = 0.2195$
output trans = 0.166

6, -15-, 4, -16-, 7

XOR(4)

input trans = 0.177
output cap = 0.1005
delay = 0.386
output transition = 0.441

FF(7)

input transition = 0.441
output cap = 0.1
setup time = 0.0895

Timing analysis

A, ②, -13-, ③, -14-, ④, -16-, ⑦

$$\text{arrival time} = 0 + 0.807 + 0.196 + 0.165 = 1.168$$

$$\text{required time} = 5 + 0.5 - 0.042 = 5.458$$

$$\text{slack} = 4.29$$

A, ②, -13-, ③, -14-, ⑥

$$\text{arrival time} = 0 + 0.807 + 0.196 = 1.003$$

$$\text{required time} = 5 + 1 - 0.0613 = 5.9378$$

$$\text{slack} = 4.9357$$

B, ①, -10-, ⑤

$$\text{arrival time} = 0.405$$

$$\text{required time} = 5 + 0.5 - 0.099 = 5.401$$

$$\text{slack} = 4.996$$

C, ①, -10-, ⑤

$$\text{arrival time} = 0.421$$

$$\text{required time} = 5 + 0.5 - 0.0976 = 5.4024$$

$$\text{slack} = 4.98$$

C, ③, -14-, ⑥

$$\text{arrival time} = 0.648$$

$$\text{required time} = 5 + 1 - 0.029 = 5.971$$

$$\text{slack} = 5.323$$

C, ③, -14-, ④, -16-, ⑦

$$\text{arrival time} = 0.648 + 0.083 = 0.731$$

$$\text{required time} = 5.5 + 0.0524 = 5.4476$$

$$\text{slack} = 4.71$$

⑤, -12-, ②, -13-, ③, -14-, ④, -16-, ⑦

$$\text{arrival time} = 0.5 + 0.3034 + 0.336 + 0.630 + 0.073 = 1.8424$$

$$\text{required time} = 5 + 0.5 - 0.048 = 5.452$$

$$\text{slack} = 3.6096$$

⑤, -12-, ②, -13-, ③, -14-, ⑥

$$\text{arrival time} = 0.5 + 0.3034 + 0.336 + 0.630 = 1.7694$$

$$\text{required time} = 5 + 1 - 0.025 = 5.975, \text{ slack} = 4.2056$$

⑥, -15-, ④, -16-, ⑦

$$\text{arrival time} = 1 + 0.236 + 0.386 = 1.622$$

$$\text{required time} = 5 + 0.5 - 0.0895 = 5.4105$$

$$\text{slack} = 3.7885$$