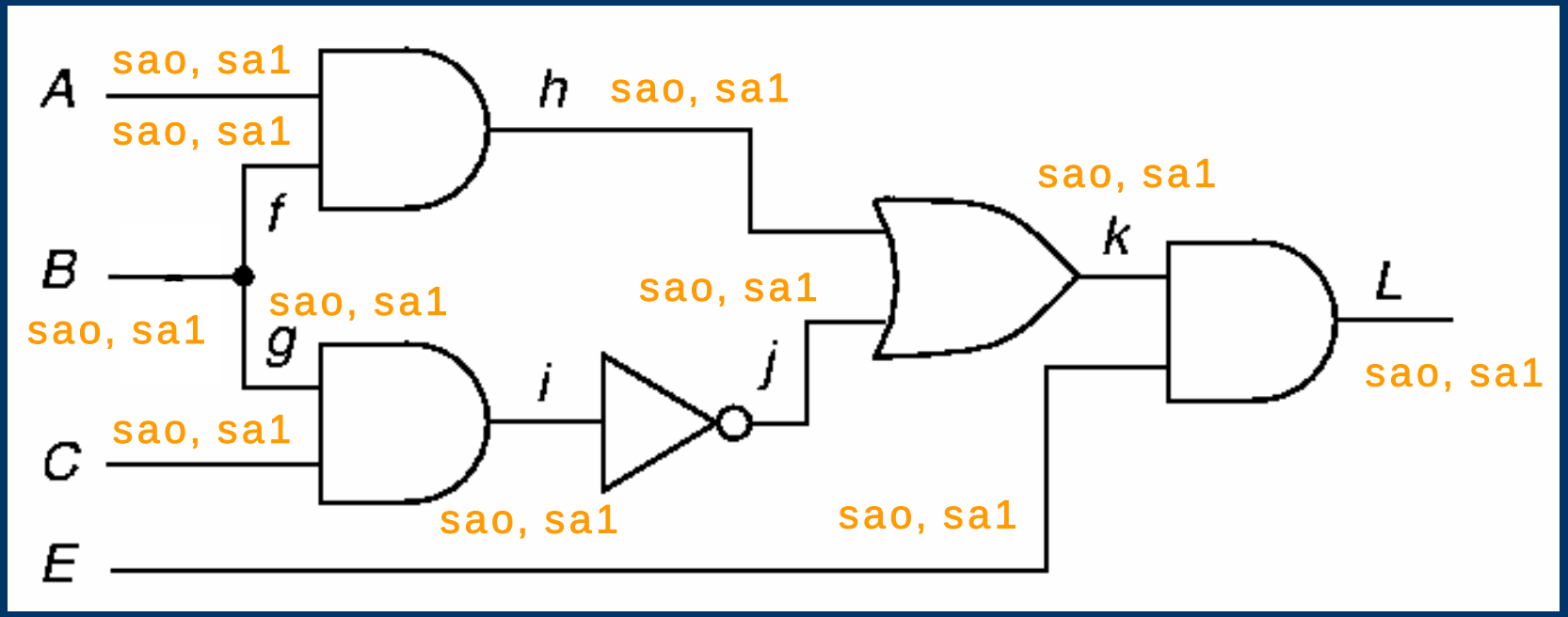
Lecture 6 – Fault Diagnosis

- Is it possible to locate faults?
- Are previous tools useful for fault diagnosis?
- Can the test sequence target fault diagnosis?

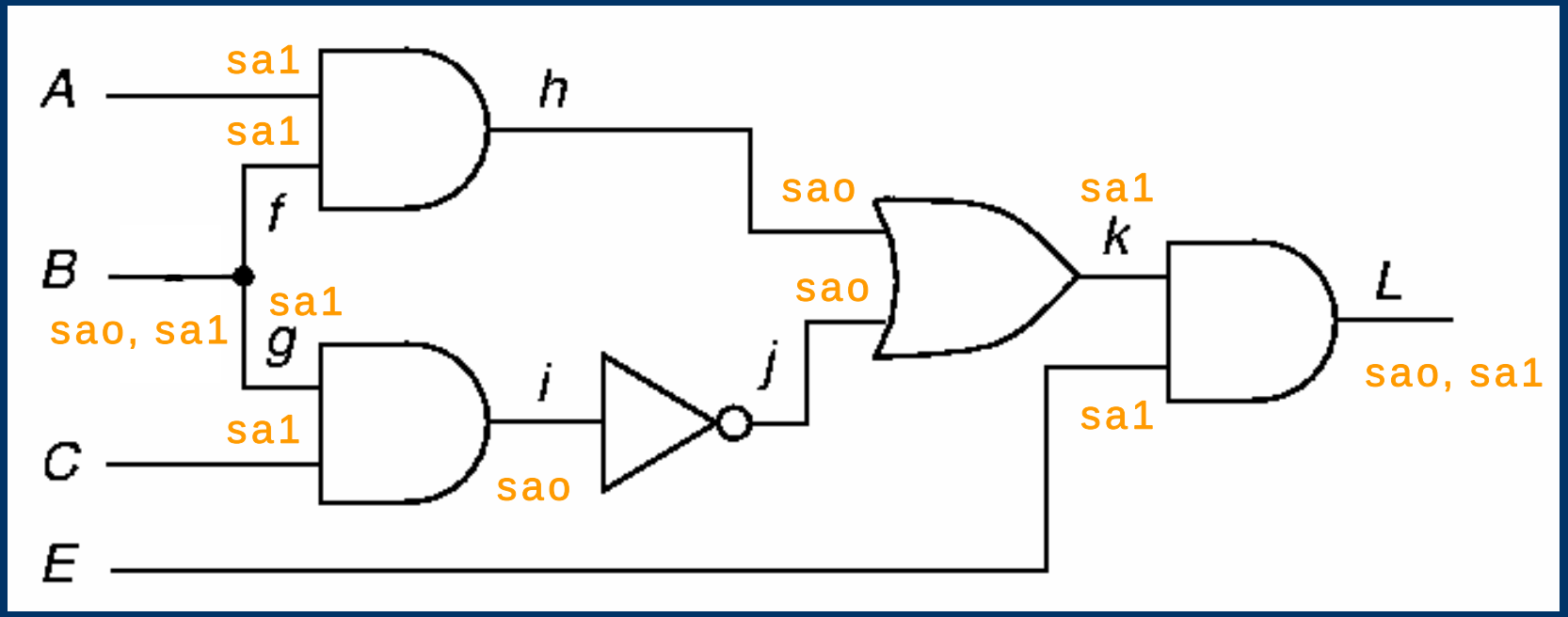
Exercise

- Fault Model: stuck-at



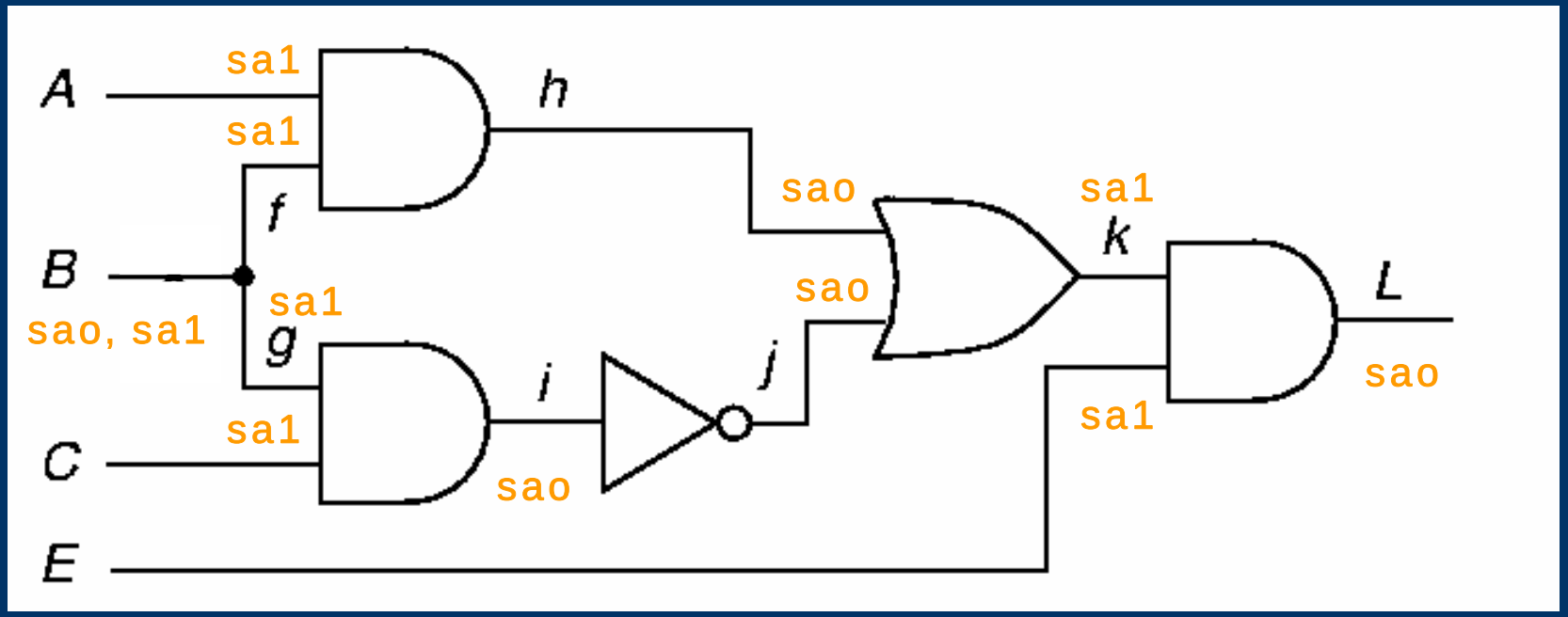
Exercise

- Fault Model: after equivalence collapsing



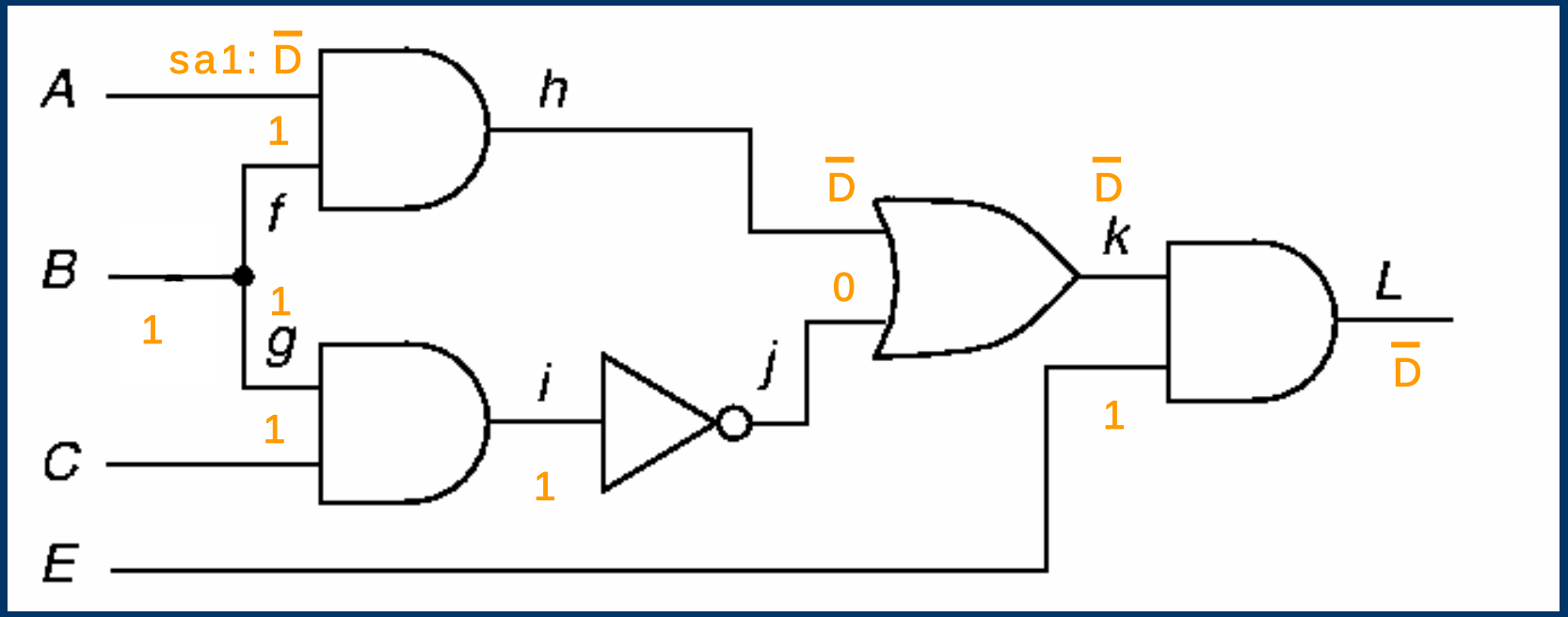
Exercise

- Fault Model: after dominance collapsing



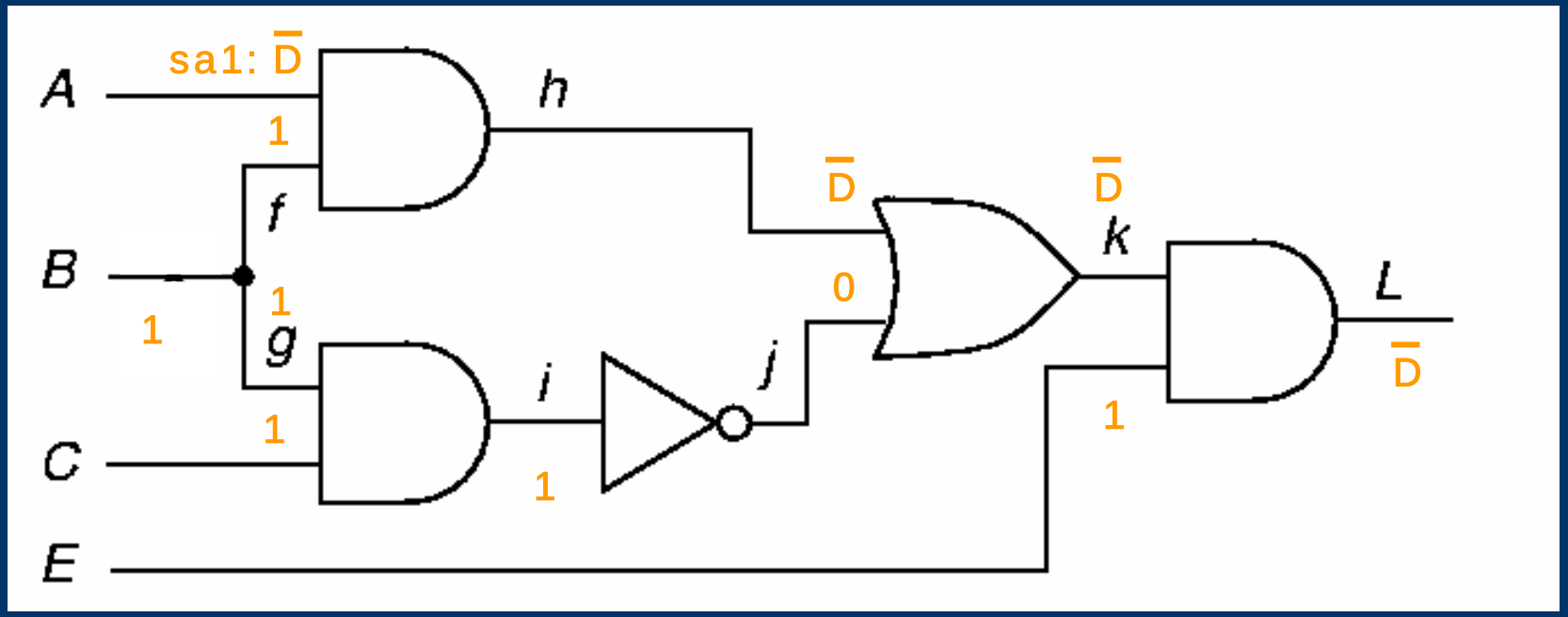
Exercise

- ATPG: A sa1



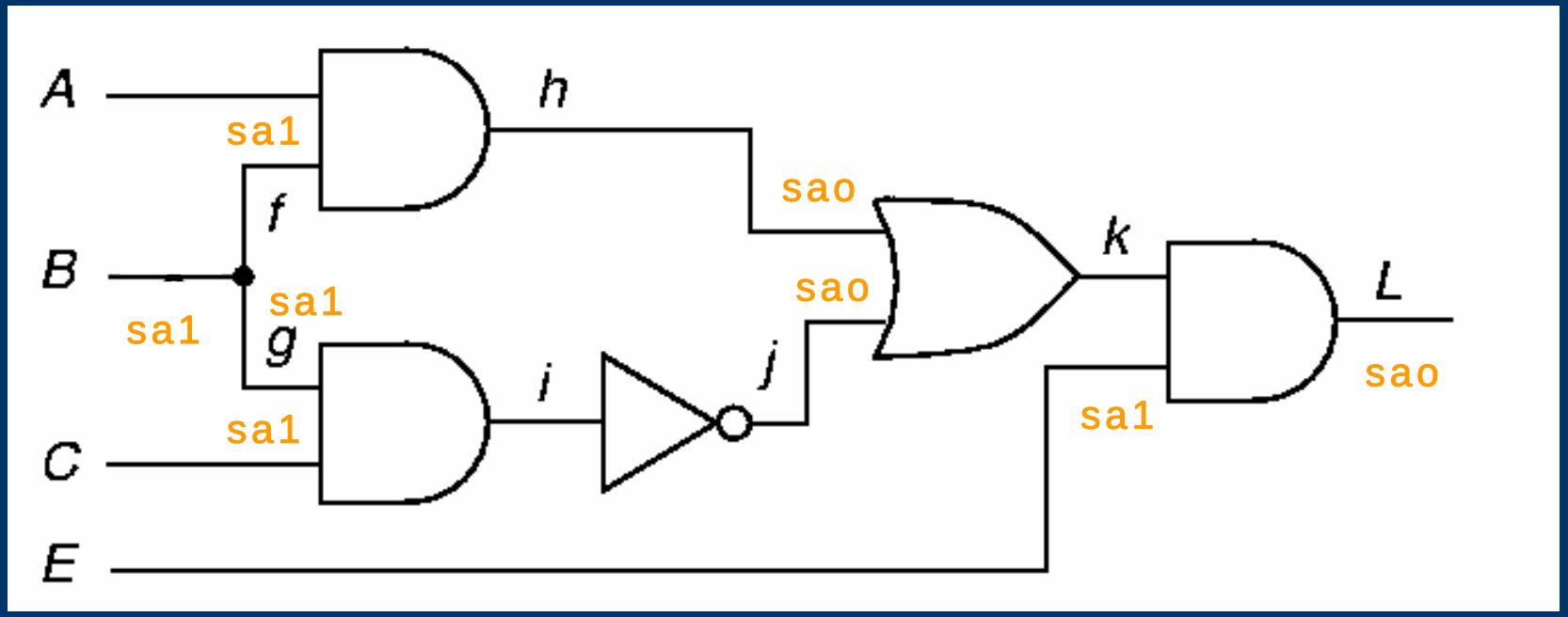
Exercise

- ATPG: A sa1
- Fault Simulation: B sa0, I sa0, K sa1, L sa1



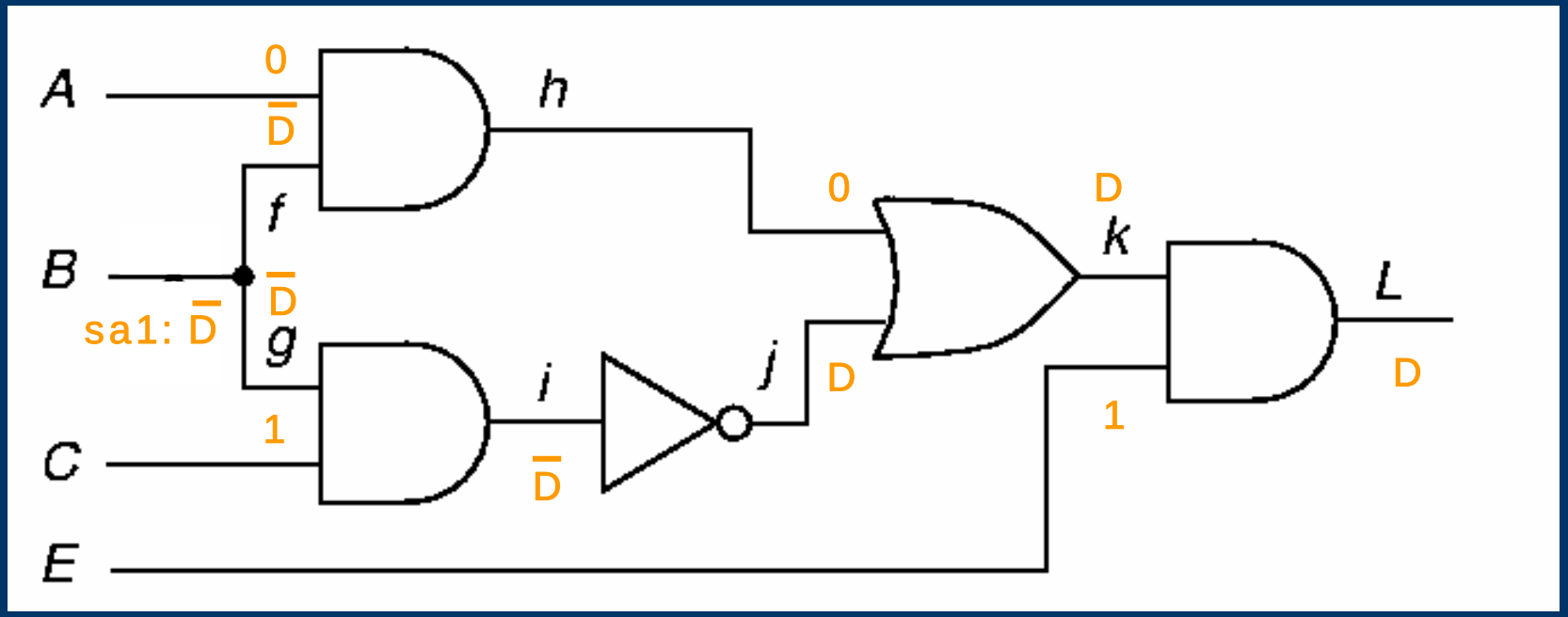
Exercise

- Test Sequence: (0,1,1,1)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, Lsa1



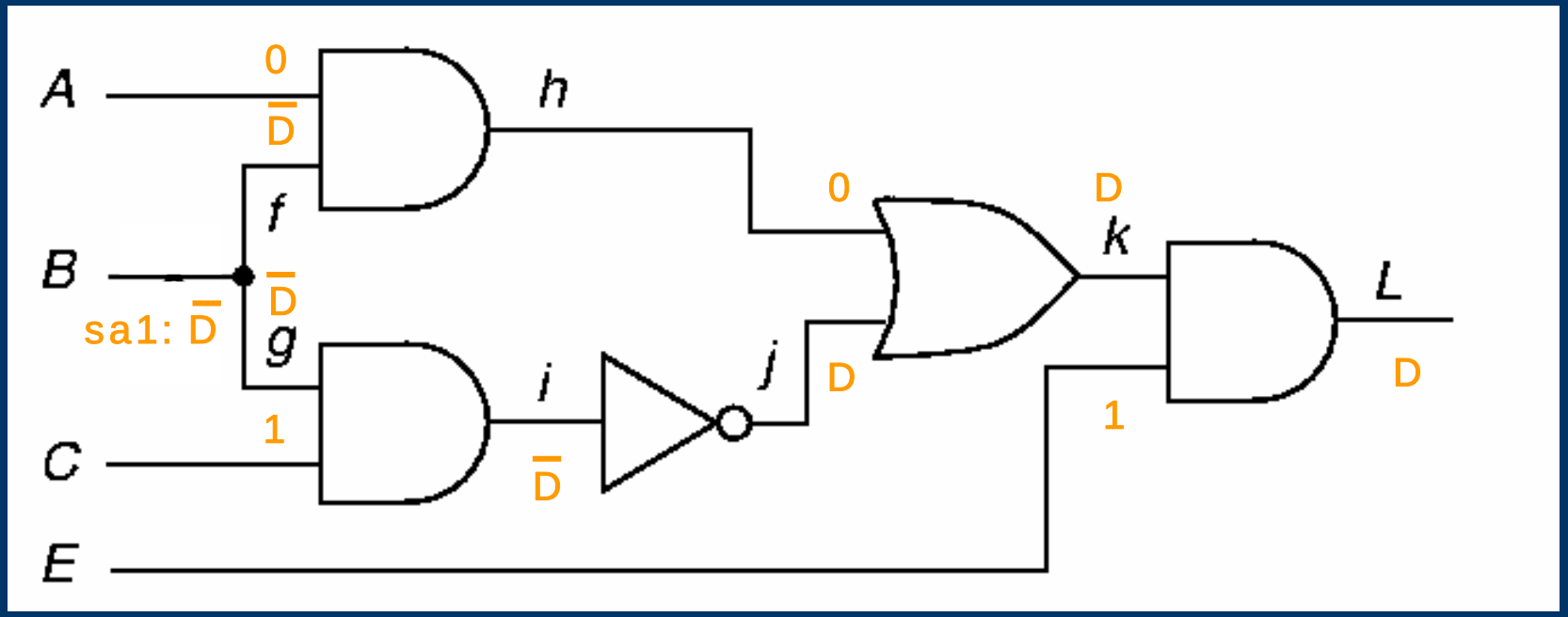
Exercise

- ATPG: B sa1



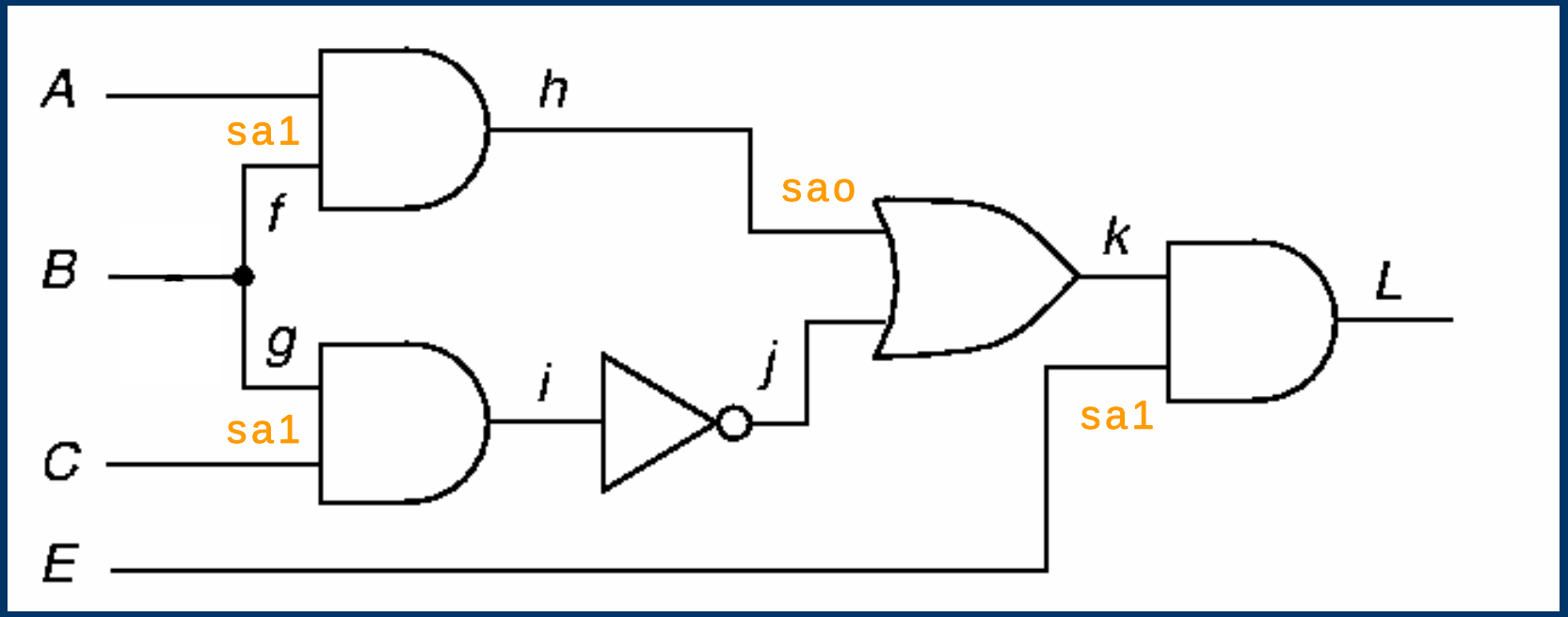
Exercise

- ATPG: B sa1
- Fault Simulation: G sa1, J st0, L st0



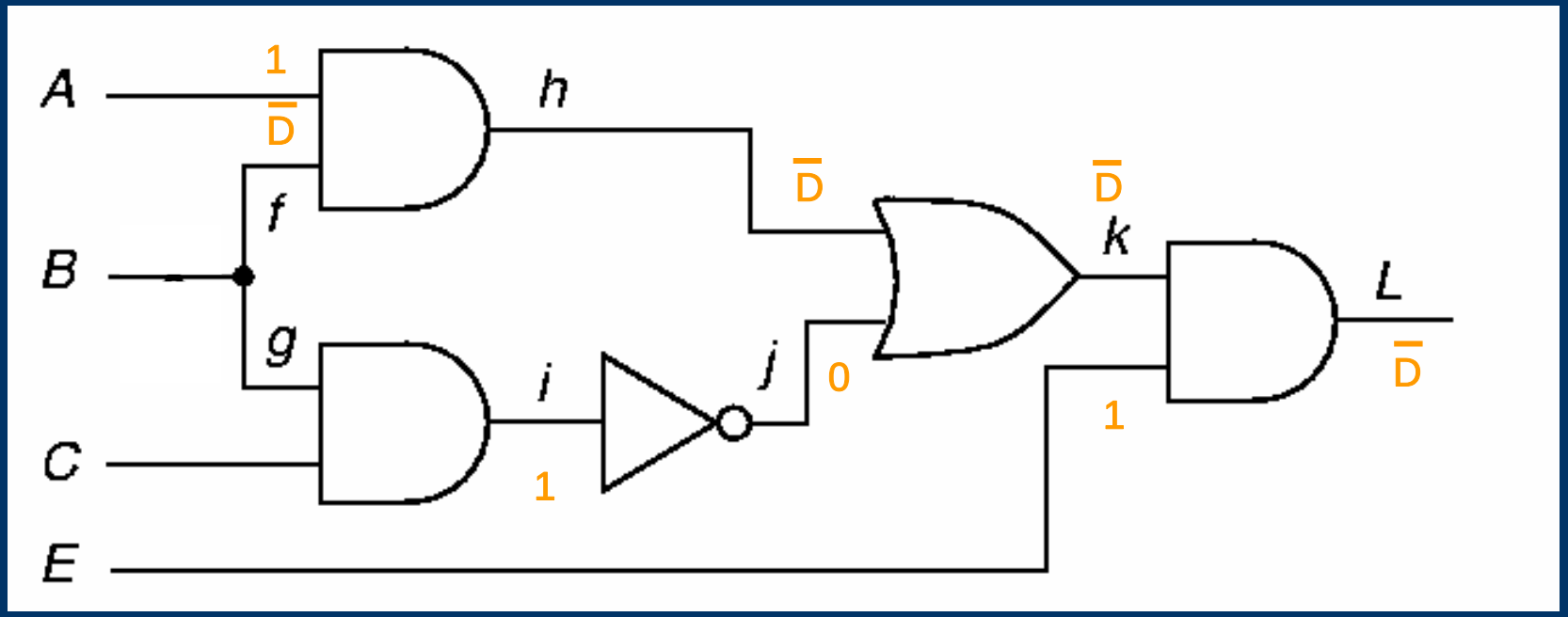
Exercise

- Test Sequence: (0,1,1,1), (0,0,1,1)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, B sa1, L sa1, G sa1, J st0, L st0



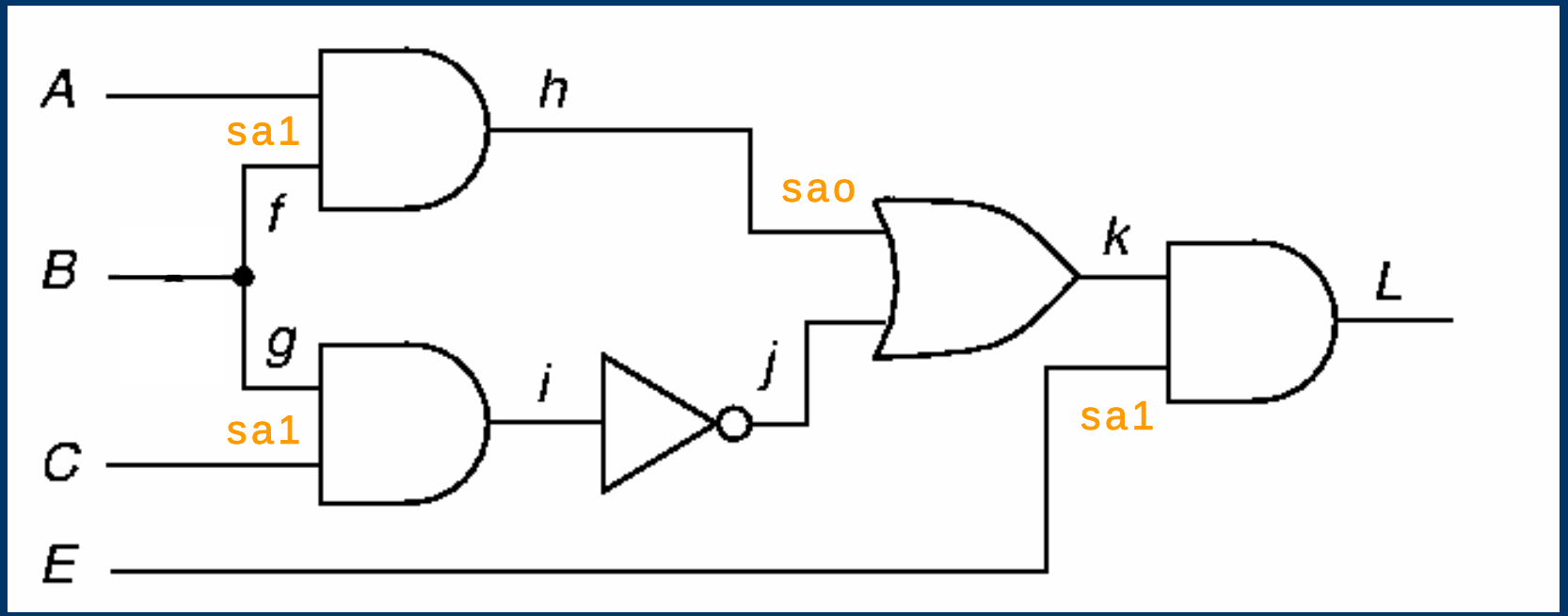
Exercise

- ATPG: F sa1
- Undetectable! **** why?? ***



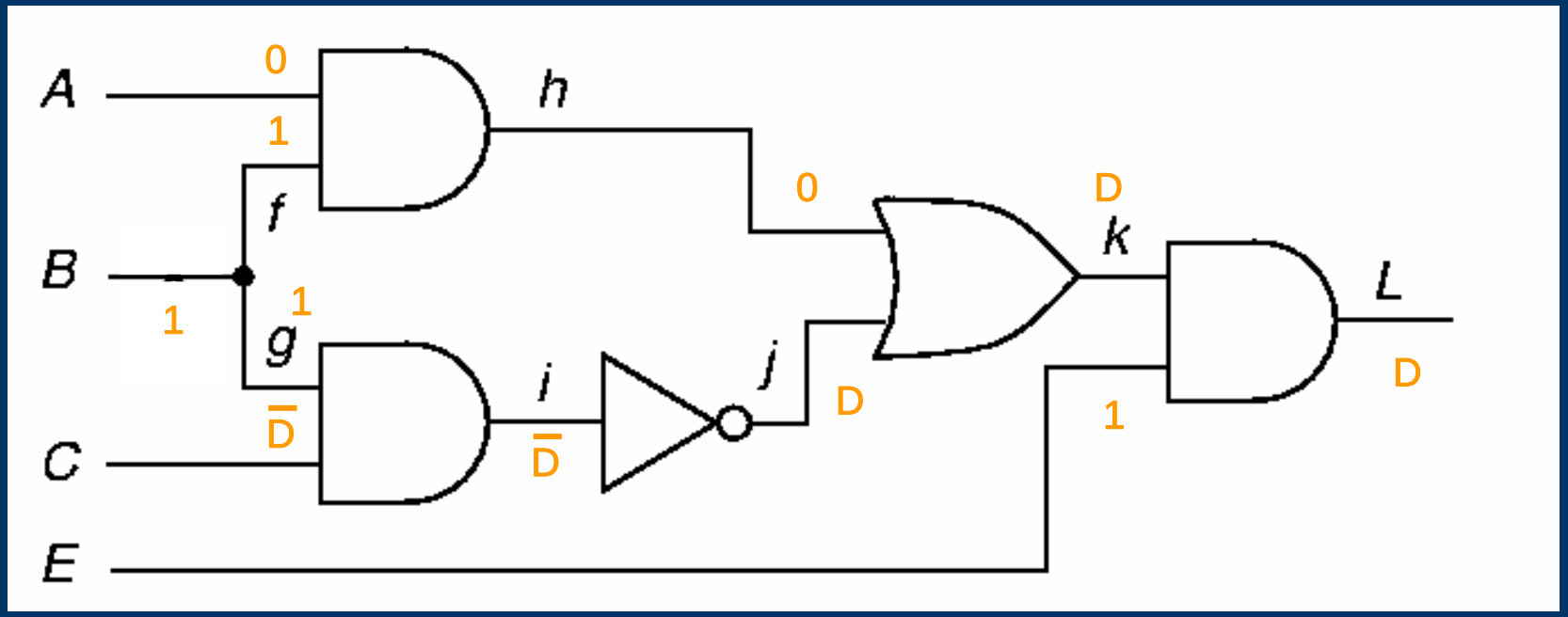
Exercise

- Test Sequence: (0,1,1,1), (0,0,1,1)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, B sa1, L sa1, G sa1, J st0, L st0
- Undetected Faults: F sa1



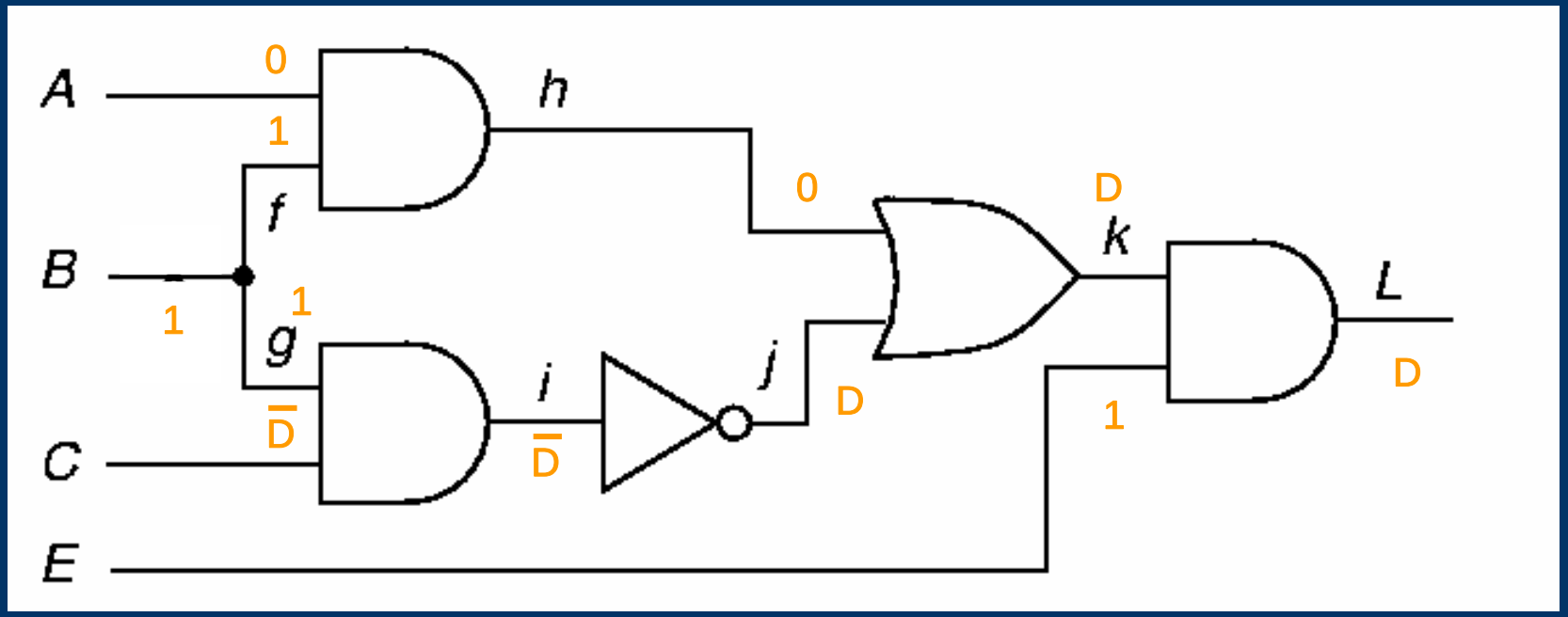
Exercise

- ATPG: C sa1



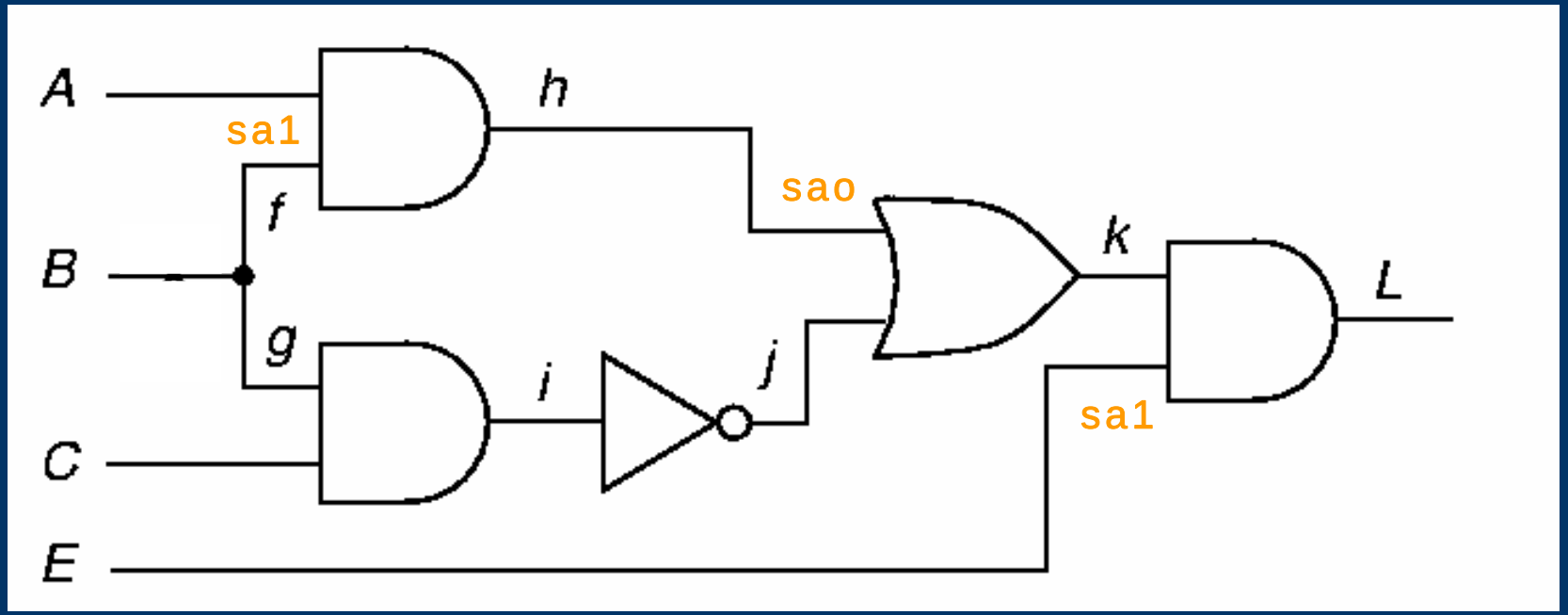
Exercise

- ATPG: C sa1
- Fault Simulation: J sa0, L sa0



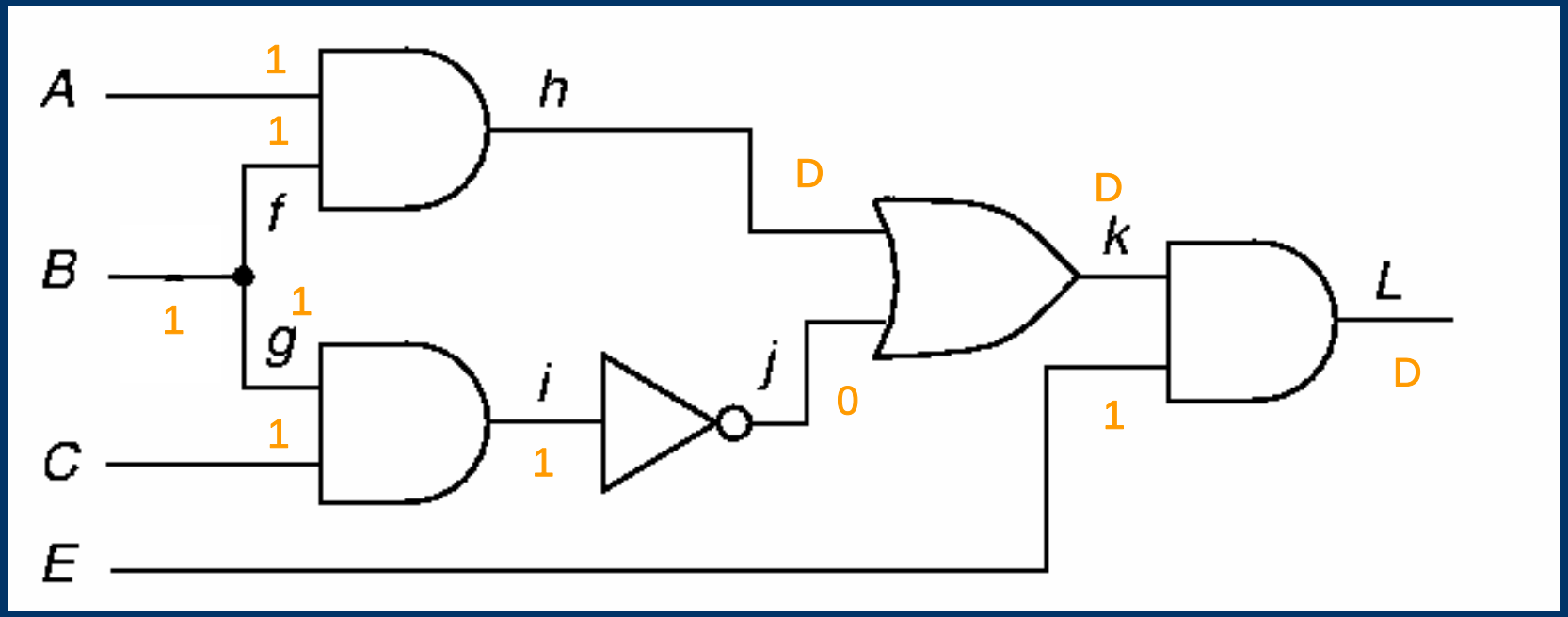
Exercise

- Test Sequence: (0,1,1,1), (0,0,1,1), (0,1,0,1)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, B sa1, L sa1, G sa1, J st0, L st0, C sa1
- Undetected Faults: F sa1



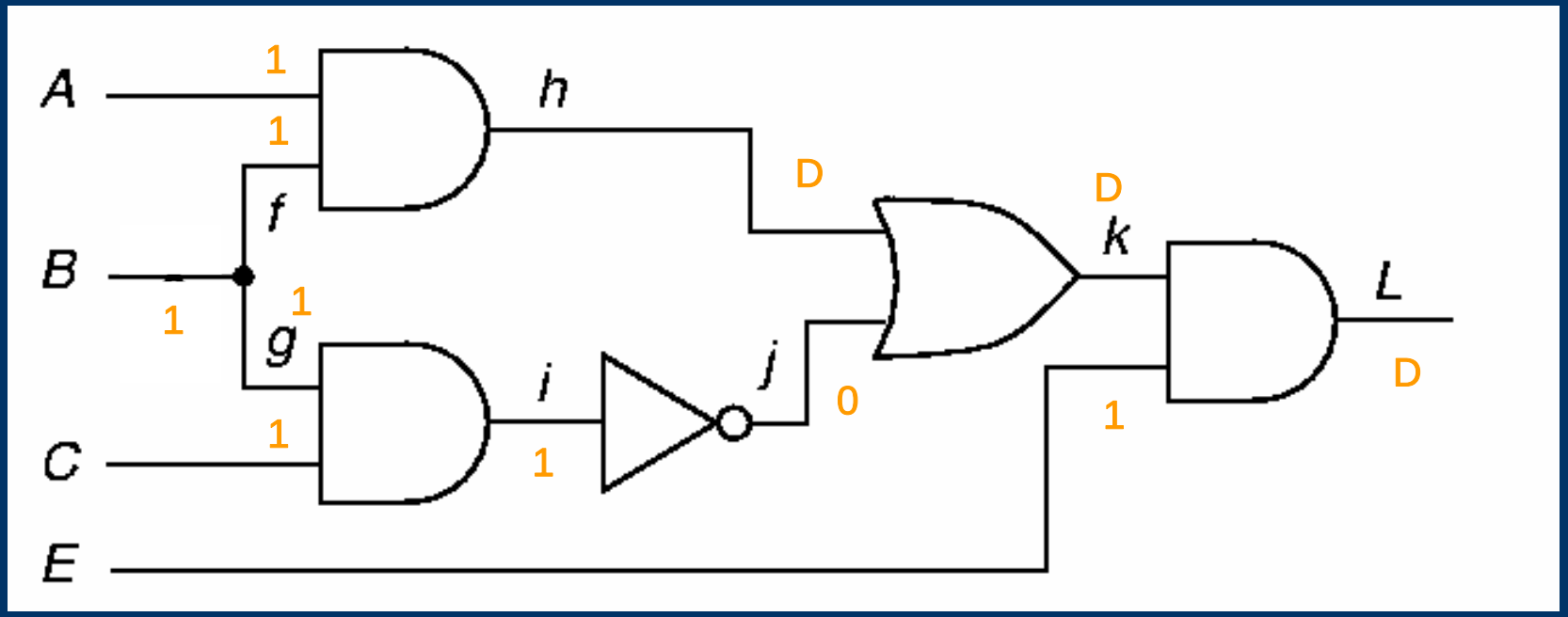
Exercise

- ATPG: H sa0



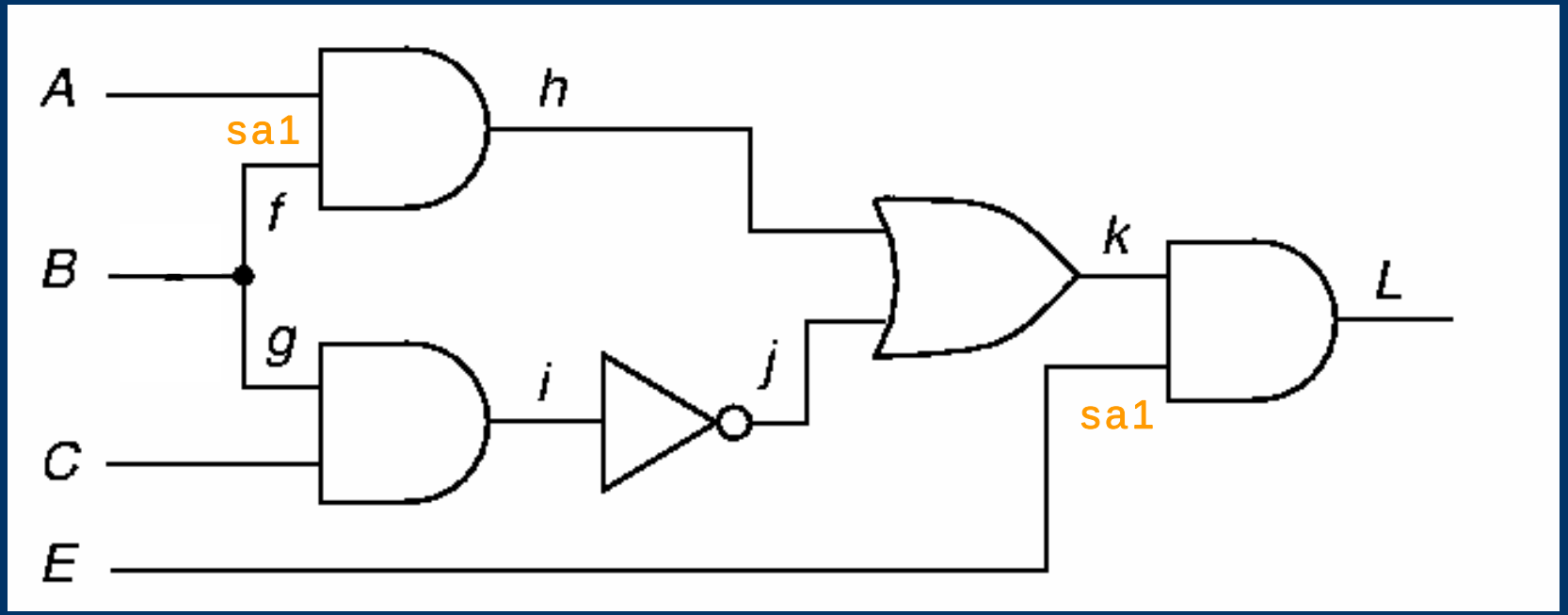
Exercise

- ATPG: H sa0
- Fault Simulation: L sa0



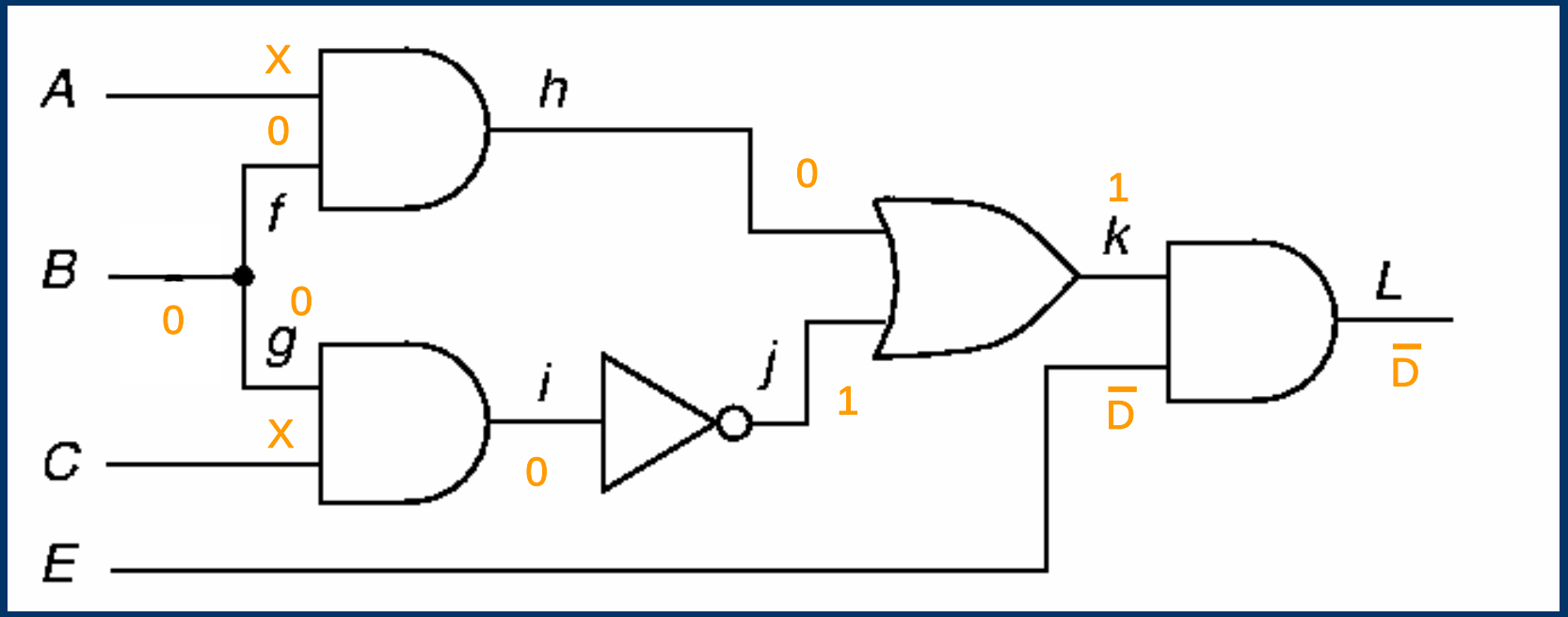
Exercise

- Test Sequence: (0,1,1,1), (0,0,1,1), (0,1,0,1), (1,1,1,1)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, B sa1, L sa1, G sa1, J st0, L st0, C sa1, H sa0
- Undetected Faults: F sa1



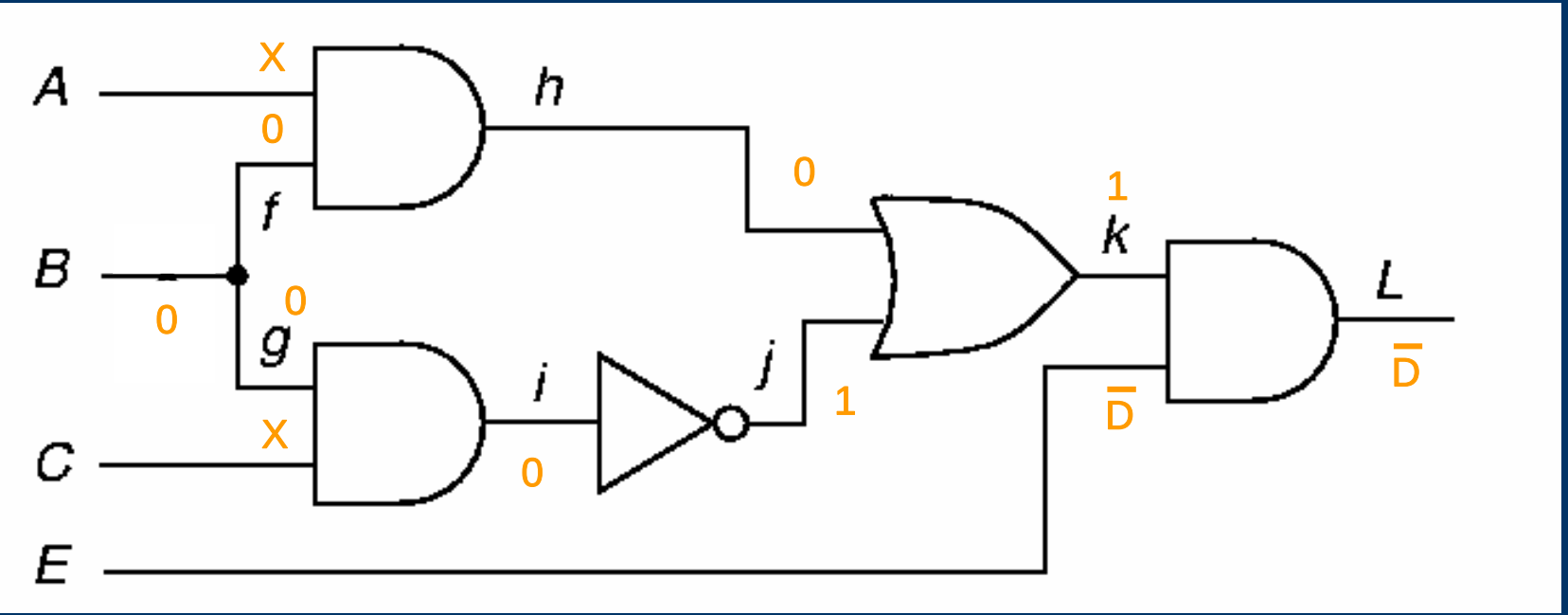
Exercise

- ATPG: E sa1



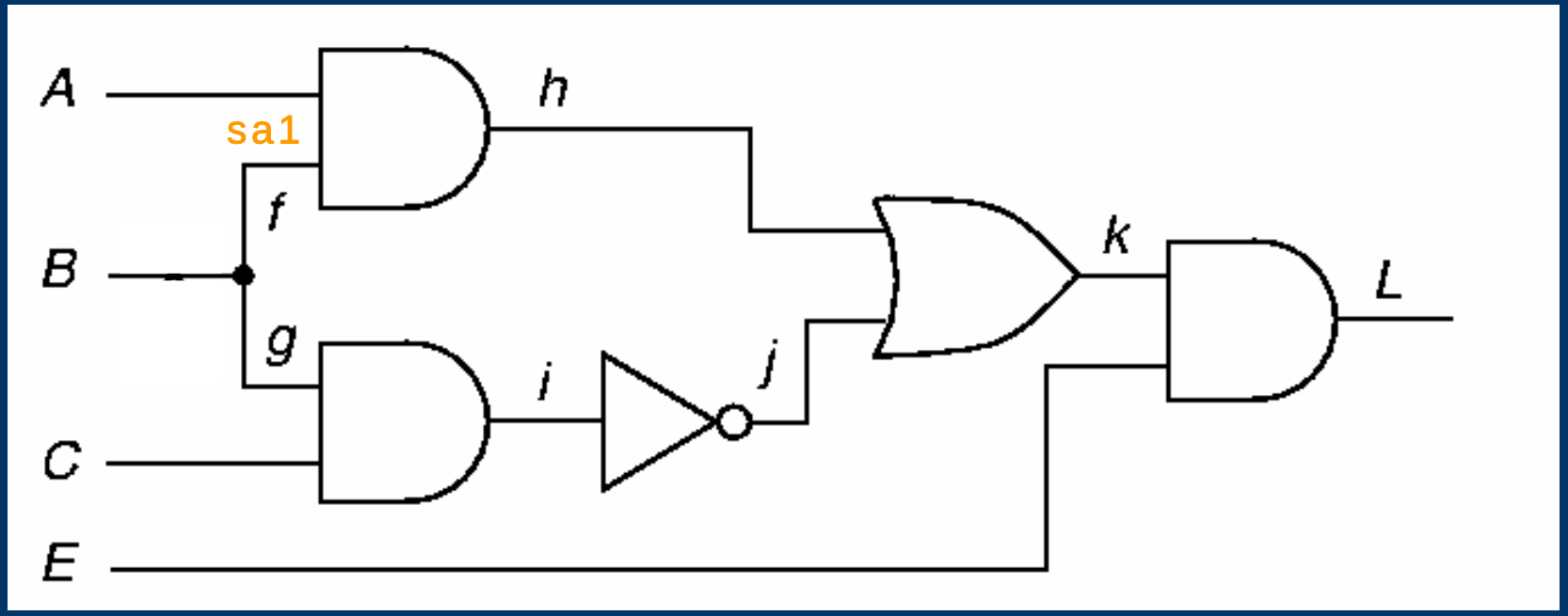
Exercise

- ATPG: E sa1
- Fault Simulation:
  - (0,0,0,0): J sa0, L sa1
  - (0,0,1,0): B sa1, G s1, J sa0, L sa1
  - (1,0,0,0): J sa0, L sa1
  - (1,0,1,0): G sa1, J sa0, L sa1



Exercise

- Test Sequence: (0,1,1,1), (0,0,1,1), (0,1,0,1), (1,1,1,1), (X,0,X,0)
- Detected Faults: A sa1, B sa0, I sa0, K sa1, B sa1, L sa1, G sa1, J st0, L st0, C sa1, H sa0, E sa1
- Undetected Faults: F sa1



Fault Dictionnary

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(0,0,0,0)	(0,0,1,0)	(1,0,0,0)	(1,0,1,0)
A sa1	X							
B sa0	X							
I sa0, G sa0, C sa0	X							
K sa1, H sa1, J sa1	X							
B sa1		X				X		
L sa1	X				X	X	X	X
G sa1		X				X		X
J sa0, I sa1		X	X		X	X	X	X
L sa0, K sa0, E sa0		X	X	X				
C sa1			X					
H sa0, A sa0, F sa0				X				
E sa1					X	X	X	X
F sa1								

Fault Diagnosis?

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(0,0,0,0)	(0,0,1,0)	(1,0,0,0)	(1,0,1,0)
A sa1	X							
B sa0	X							
I sa0, G sa0, C sa0	X							
K sa1, H sa1, J sa1	X							
B sa1		X				X		
L sa1	X				X	X	X	X
G sa1		X				X		X
J sa0, I sa1		**X**	**X**		X	X	X	X
L sa0, K sa0, E sa0		**X**	**X**	**X**				
C sa1			**X**					
H sa0, A sa0, F sa0				**X**				
E sa1					X	X	X	X
F sa1								

Fault Diagnosis?

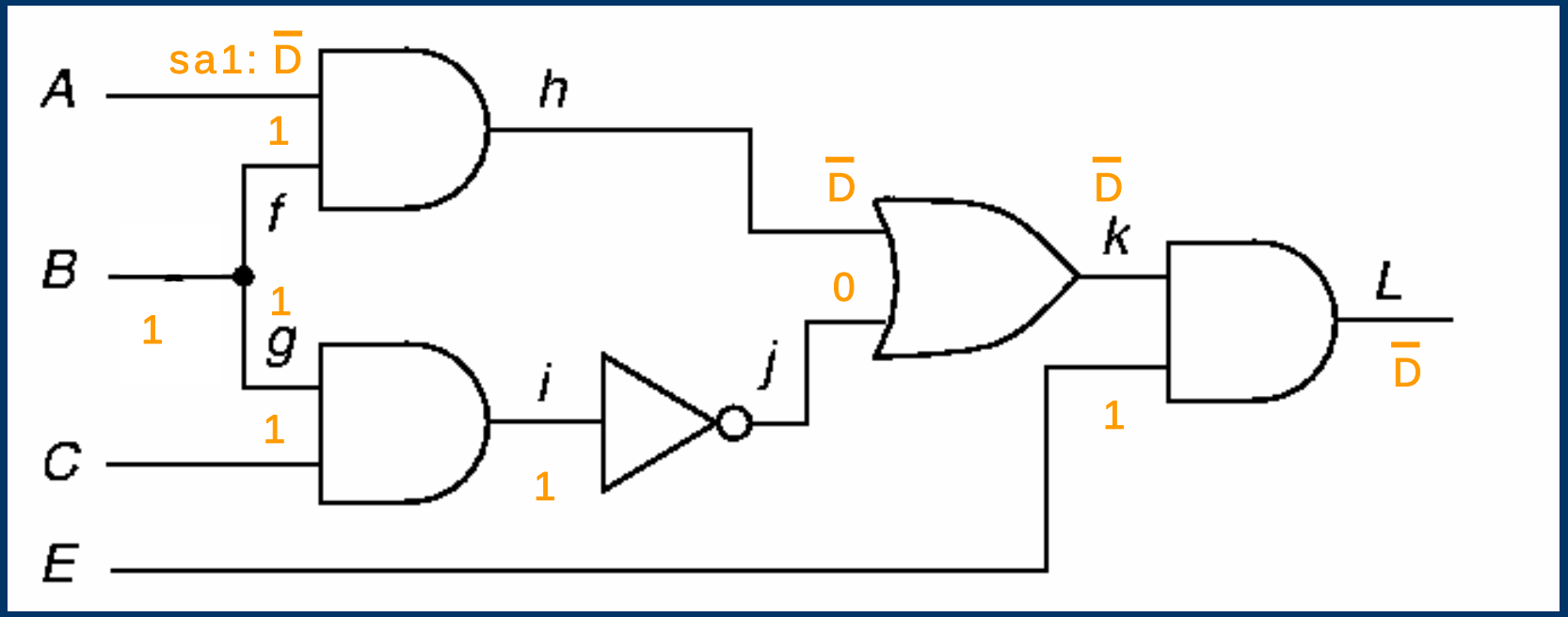
Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(0,0,0,0)	(0,0,1,0)	(1,0,0,0)	(1,0,1,0)
A sa1	X							
B sa0	X							
I sa0, G sa0, C sa0	X							
K sa1, H sa1, J sa1	X							
B sa1		**X**				X		
L sa1	**X**				X	X	X	**X**
G sa1		**X**				X		**X**
J sa0, I sa1		**X**	**X**		X	X	X	**X**
L sa0, K sa0, E sa0		**X**	**X**	**X**				
C sa1			**X**					
H sa0, A sa0, F sa0				**X**				
E sa1					X	X	X	**X**
F sa1								

Fault Diagnosis?

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(1,0,1,0)
A sa1	X				
B sa0	X				
I sa0, G sa0, C sa0	X				
K sa1, H sa1, J sa1	X				
B sa1		X			
L sa1	X	X			X
G sa1		X			X
J sa0, I sa1		X	X		X
L sa0, K sa0, E sa0		X	X	X	
C sa1			X		
H sa0, A sa0, F sa0				X	
E sa1					X
F sa1					

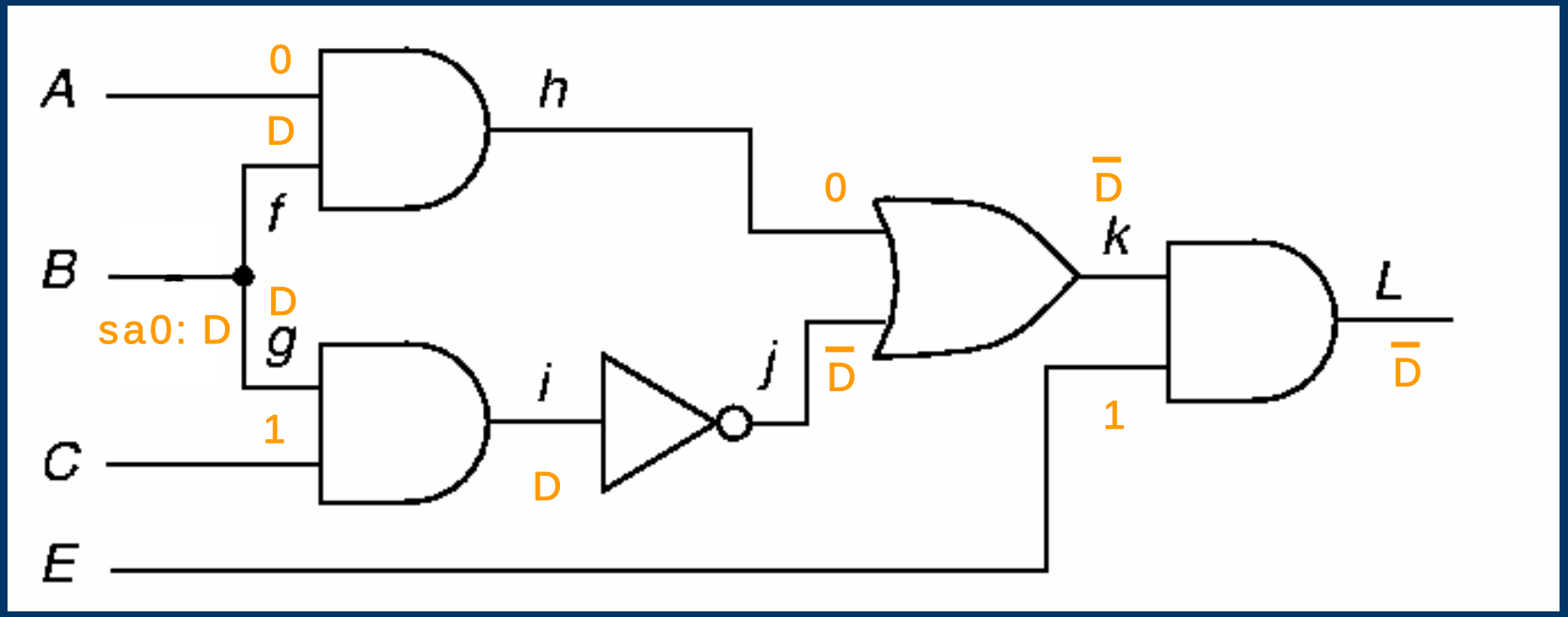
Solving Fault Diagnosis

- ATPG: A sa1



Solving Fault Diagnosis

- ATPG: B sa0?

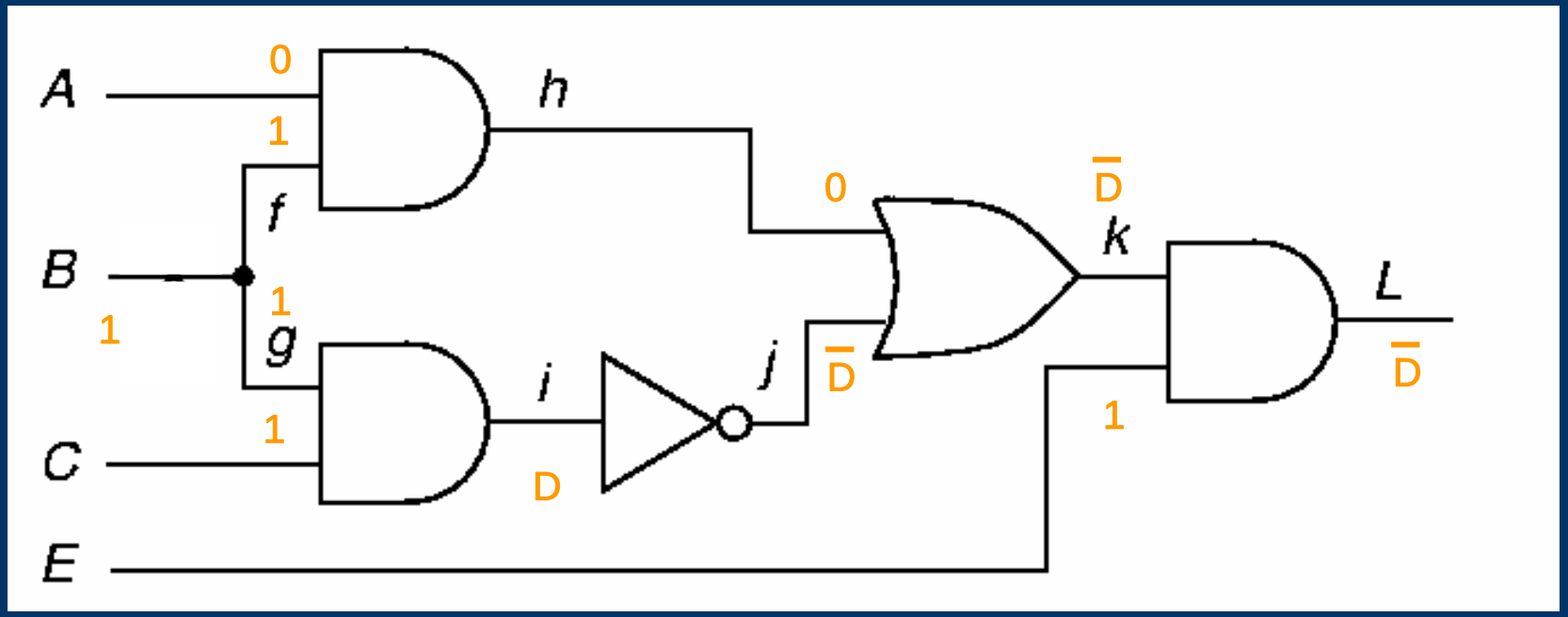


Fault Diagnosis?

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(1,0,1,0)
A sa1, B sa0	X				
I sa0, G sa0, C sa0	X				
K sa1, H sa1, J sa1	X				
B sa1		X			
L sa1	X	X			X
G sa1		X			X
J sa0, I sa1		X	X		X
L sa0, K sa0, E sa0		X	X	X	
C sa1			X		
H sa0, A sa0, F sa0				X	
E sa1					X
F sa1					

Solving Fault Diagnosis

- ATPG: I sa0?

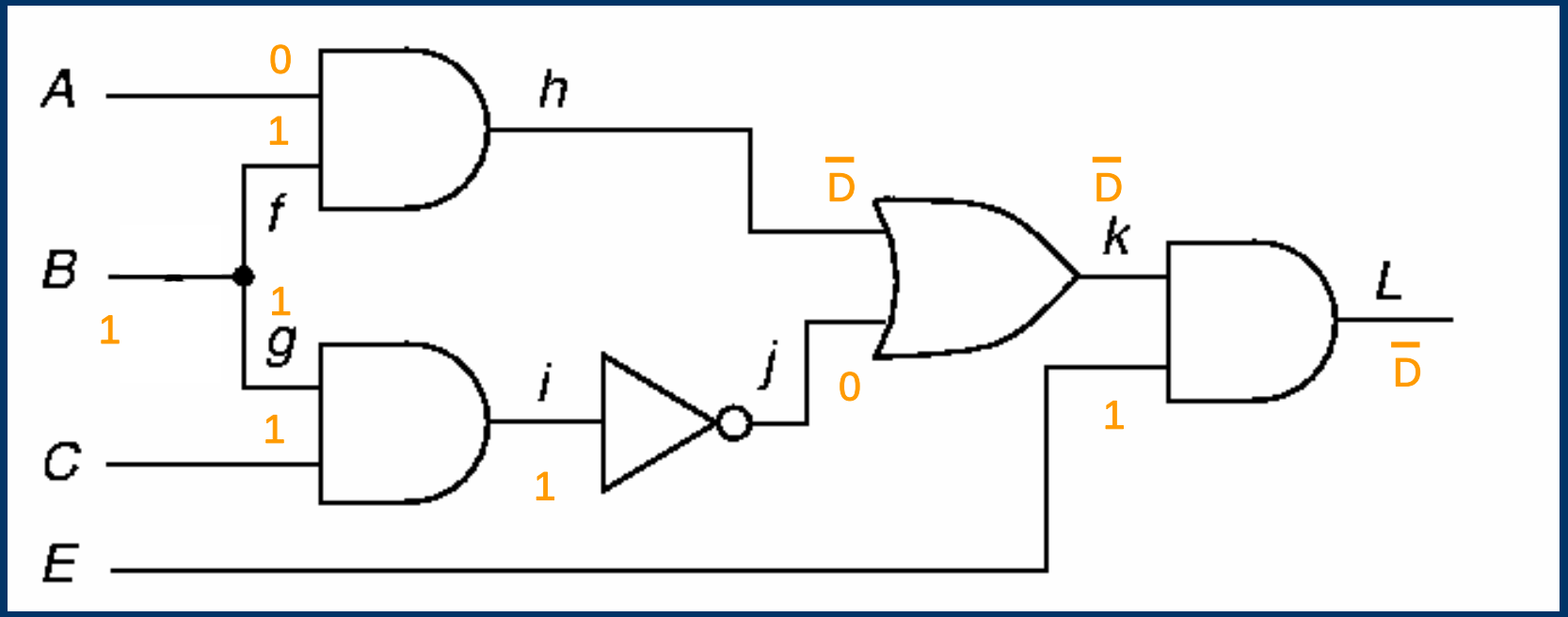


Fault Diagnosis?

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(1,0,1,0)
A sa1, B sa0, I sa0, G sa0, C sa0	X				
K sa1, H sa1, J sa1	X				
B sa1		X			
L sa1	X	X			X
G sa1		X			X
J sa0, I sa1		X	X		X
L sa0, K sa0, E sa0		X	X	X	
C sa1			X		
H sa0, A sa0, F sa0				X	
E sa1					X
F sa1					

Solving Fault Diagnosis

- ATPG: K sa1?



Fault Diagnosis?

Fault	(0,1,1,1)	(0,0,1,1)	(0,1,0,1)	(1,1,1,1)	(1,0,1,0)
A sa1, B sa0, I sa0, G sa0, C sa0, K sa1, H sa1, J sa1	**X**				
B sa1		**X**			
L sa1	**X**	**X**			X
G sa1		**X**			**X**
J sa0, I sa1		**X**	**X**		X
L sa0, K sa0, E sa0		**X**	**X**	**X**	
C sa1			**X**		
H sa0, A sa0, F sa0				**X**	
E sa1					**X**
F sa1					