

Model-Based Testing

(DIT848 / DAT261)

Spring 2016

Lecture 9

Graph Theory Techniques in MBT

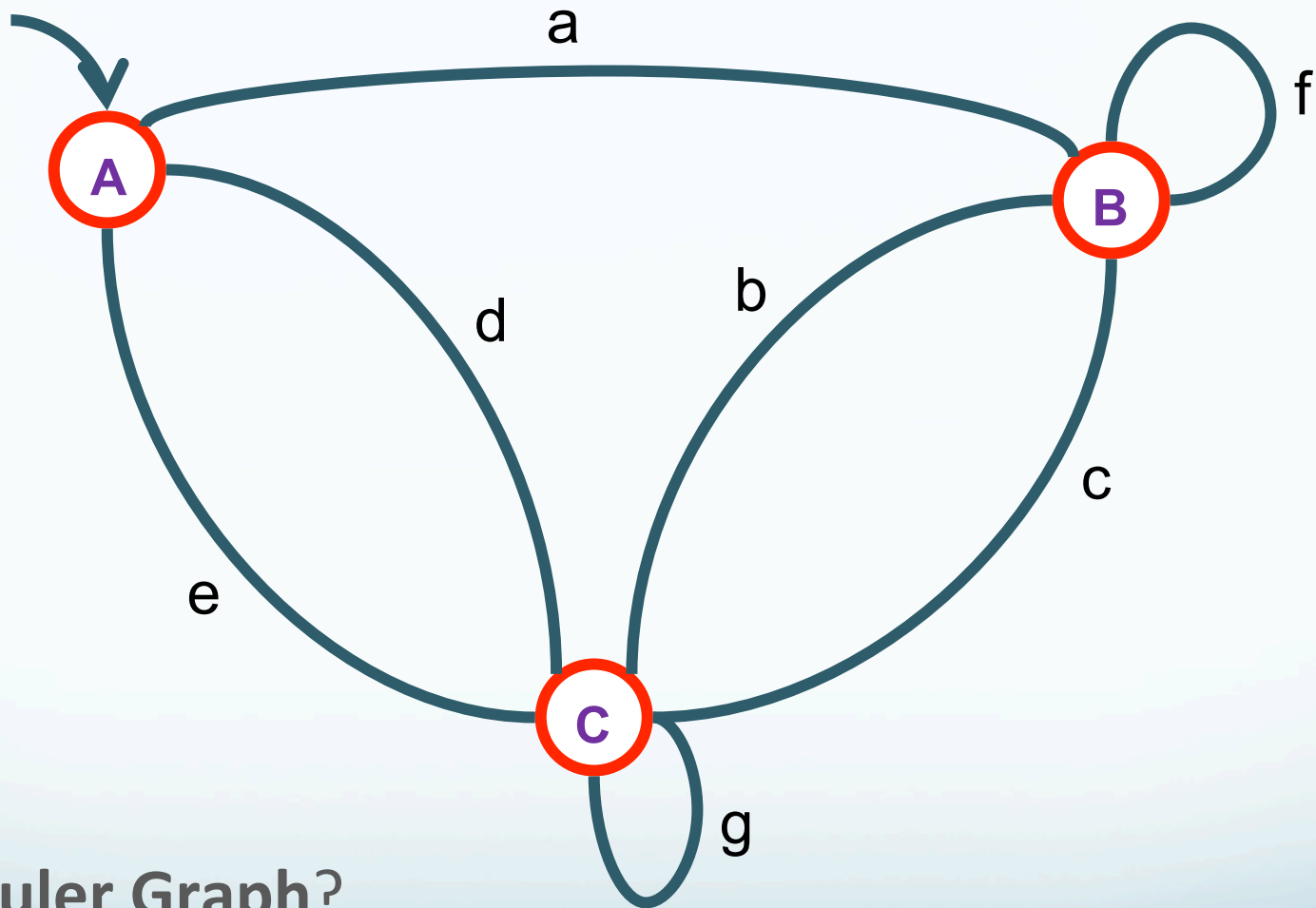
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Outline

- *Graph Theory Techniques in Model-Based Testing*, **by**, Harry Robinson
- Interactive exercises

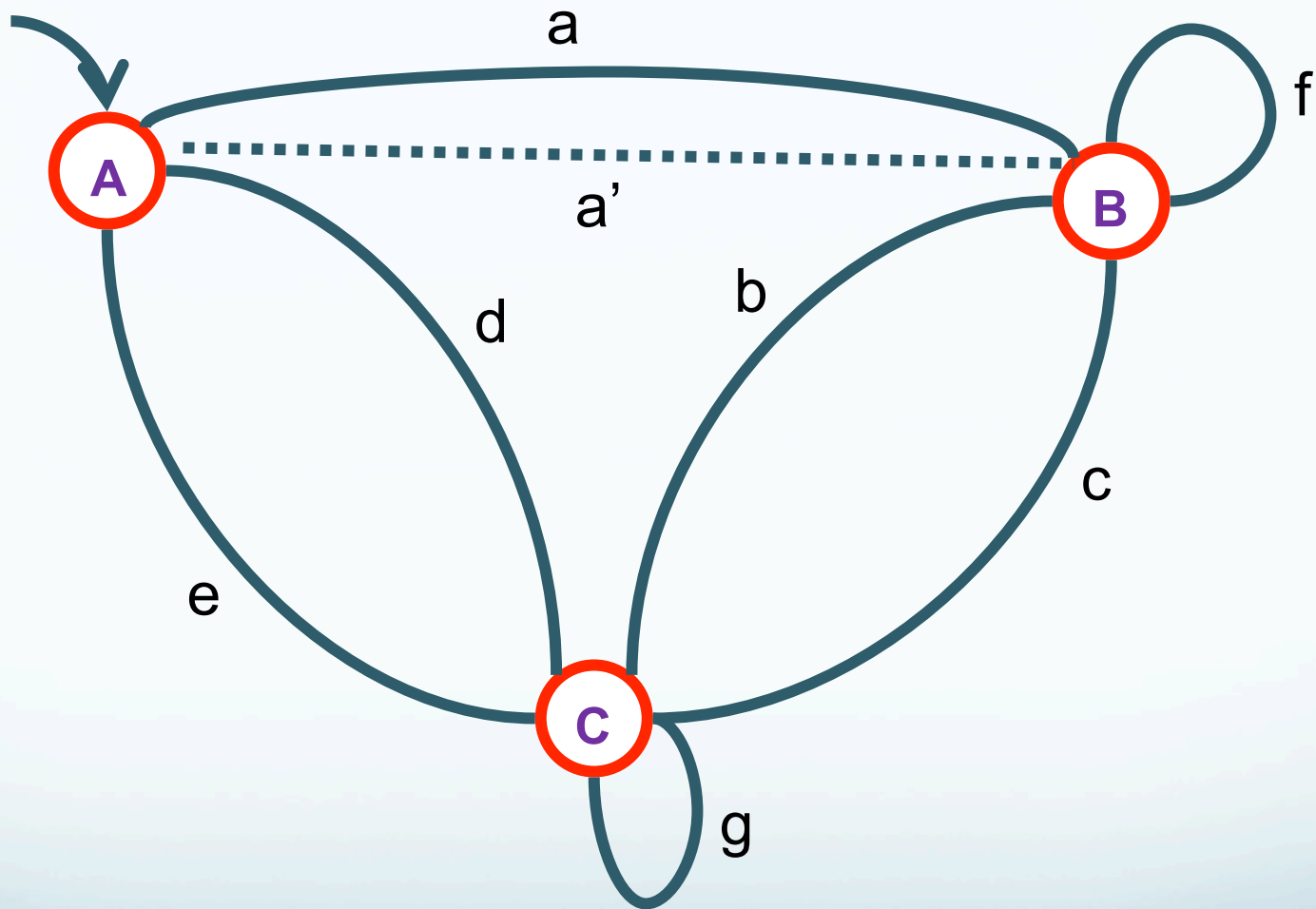
Euler Graph



Is it an **Euler Graph**?

Answer: No, not possible to traverse all the edges without repetition (nodes A and B have an odd number of links)

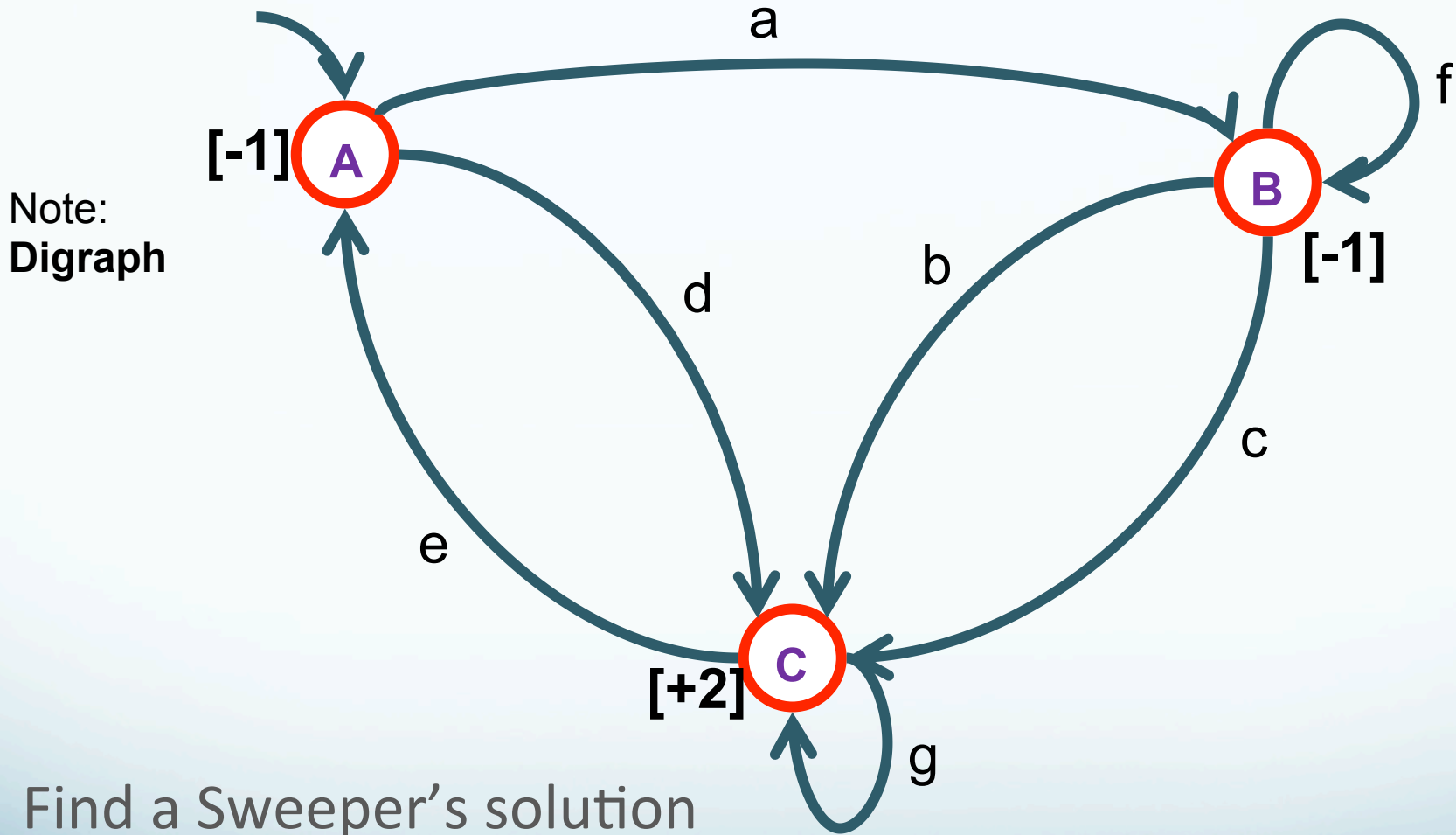
Postman Problem



Find a “Chinese” Postman’s solution

Answer: “Eulerize” the graph (**afbgca’de**)

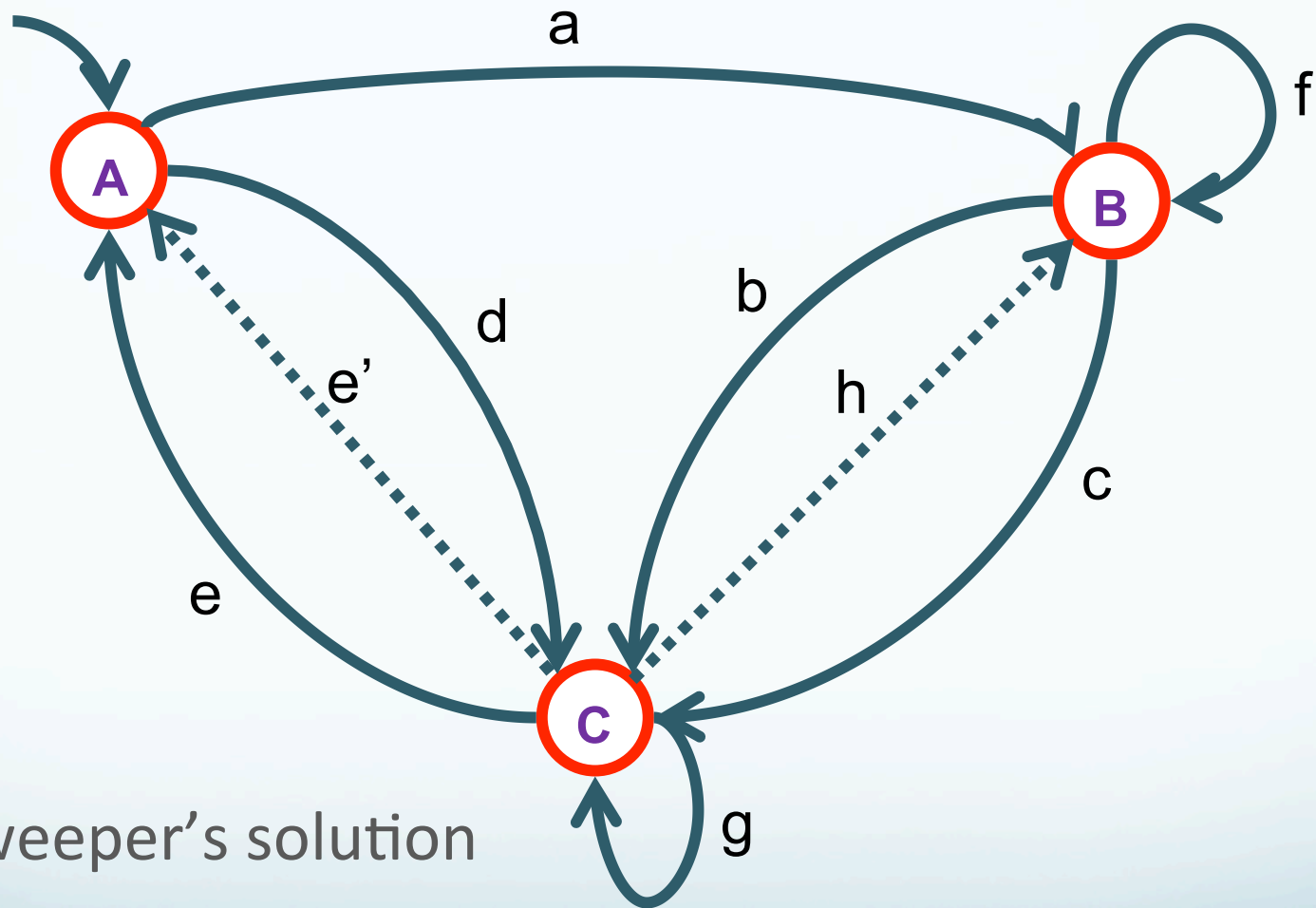
New York Street Sweeper



Answer: "Eulerize" the Digraph

New York Street Sweeper

Note:
Digraph



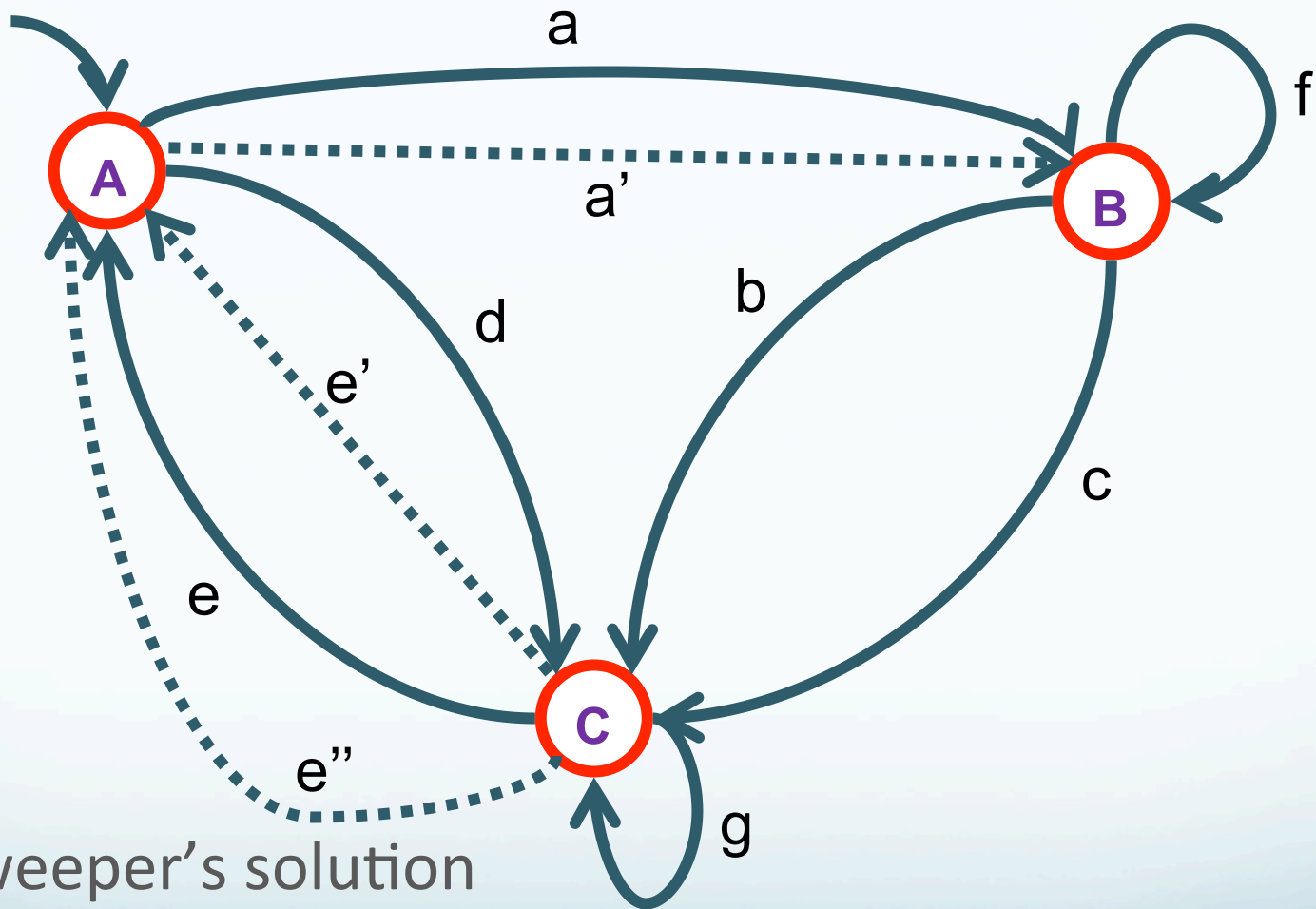
Find a Sweeper's solution

"Proposal 1": afbhcgede'

→ **NOT A SOLUTION!** (we assume there is another "street" from C till B)

New York Street Sweeper

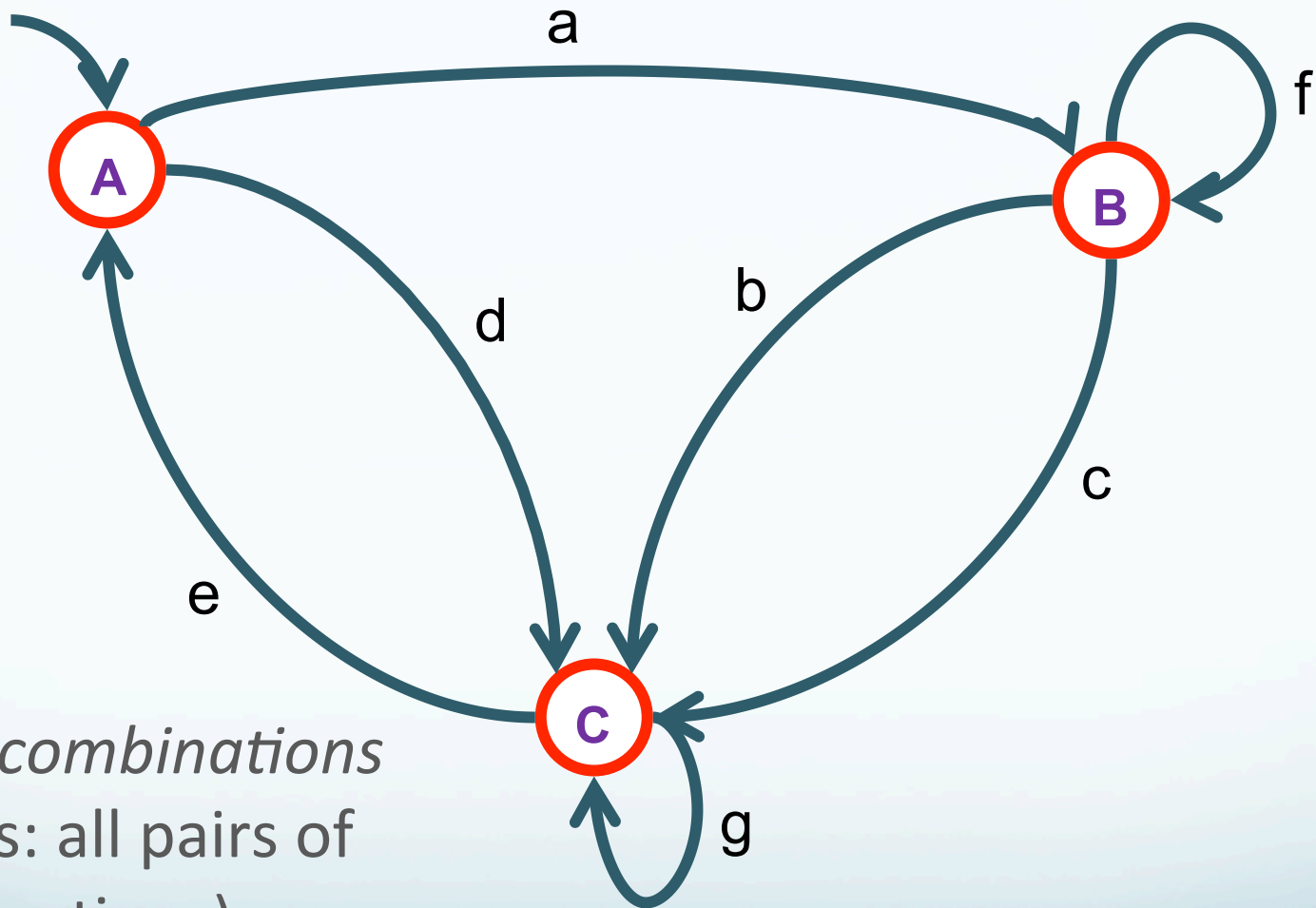
Note:
Digraph



Find a Sweeper's solution

Solution: $afbgea'ce'de''$ (we only use existing "streets")

Testing Combination of Actions



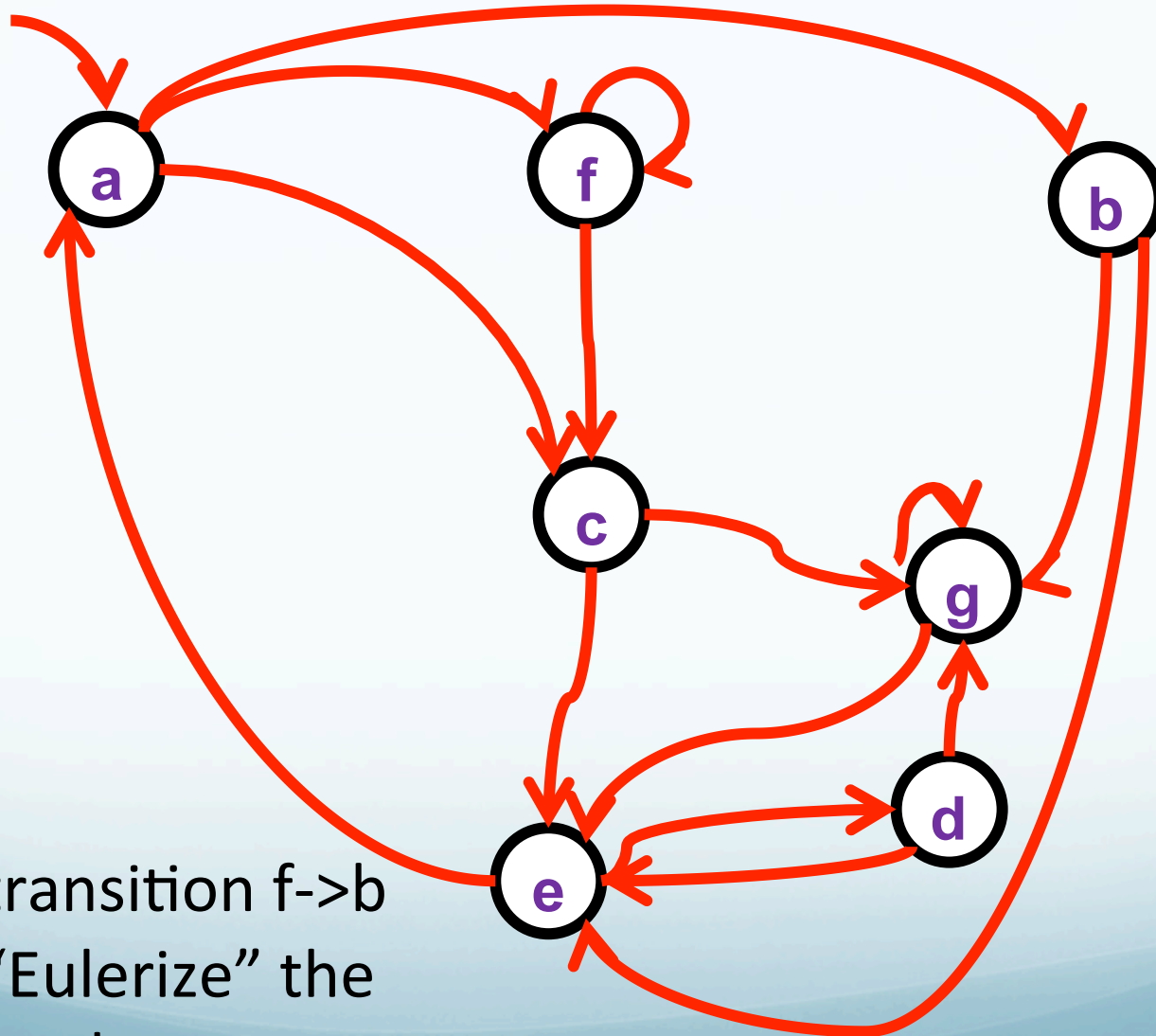
Test *link combinations*
(2 actions: all pairs of adjacent actions)

Solution: Transform the graph using de Bruijn's algorithm
(**dual** digraph)

8
Groups 2-5 persons: 10 min

Testing Combination of Actions

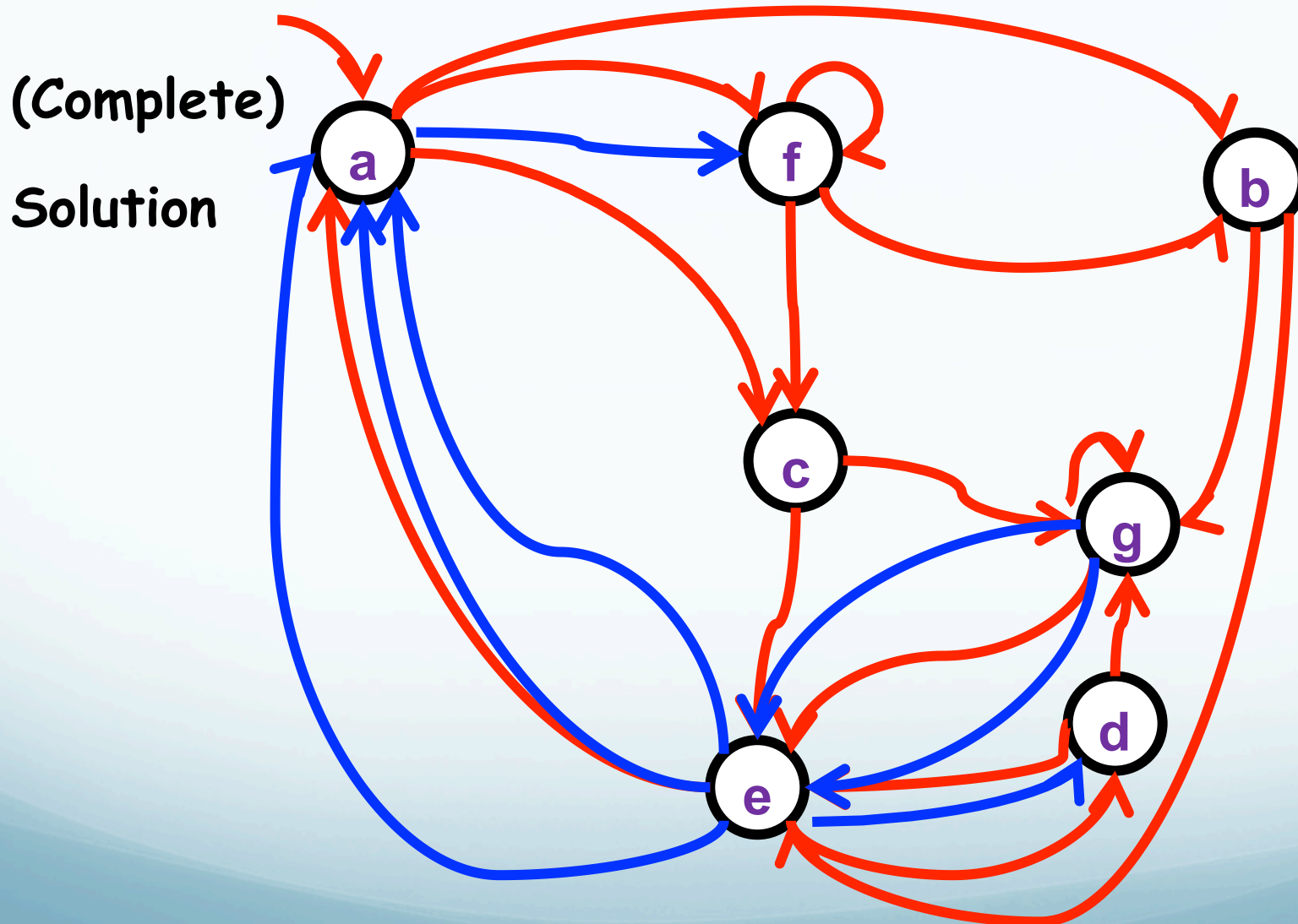
Solution



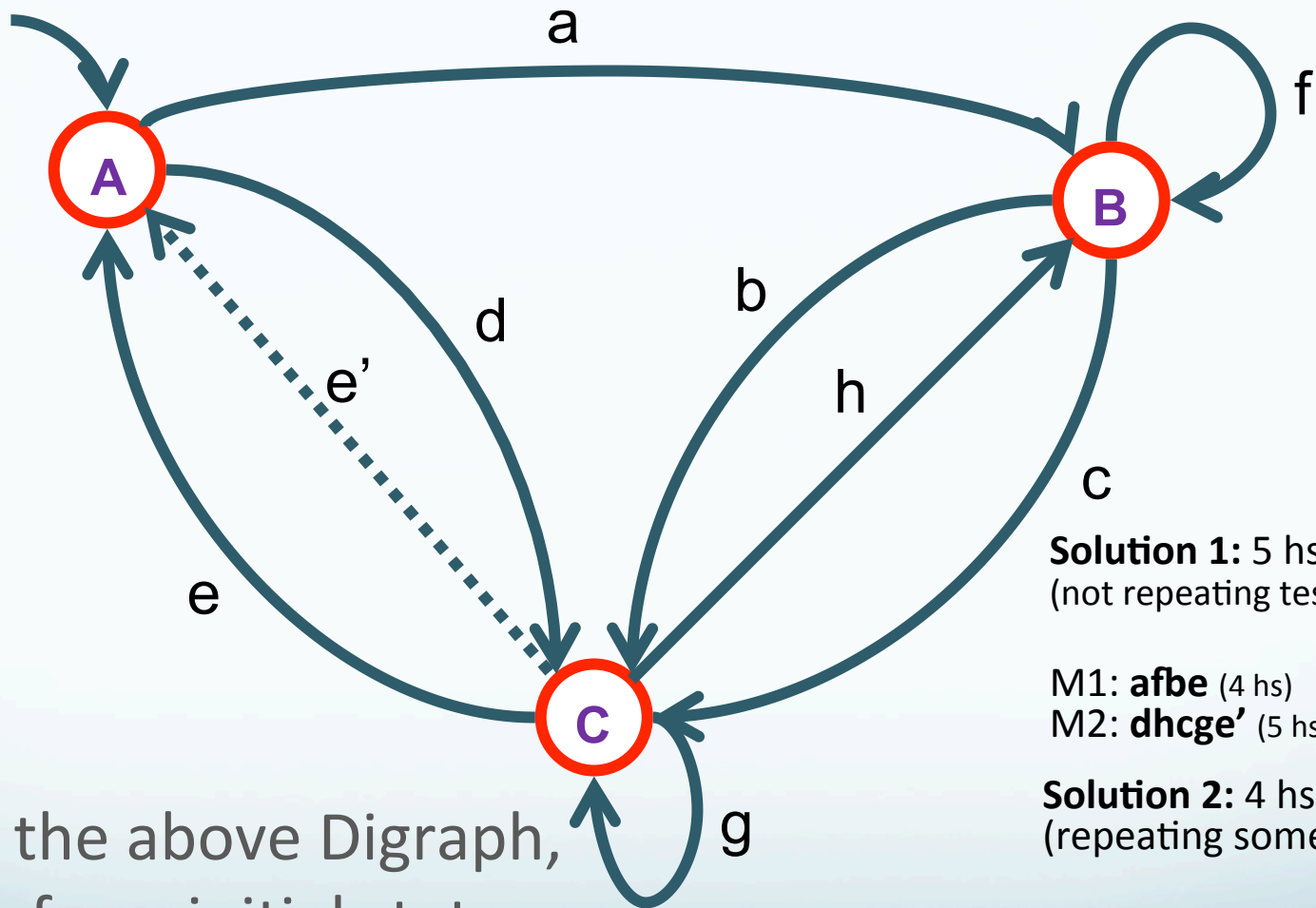
Problems:

- "Forgot" transition $f \rightarrow b$
- Need to "Eulerize" the resulting graph

Testing Combination of Actions



Testing under a Time Deadline



Solution 1: 5 hs
(not repeating tests)

M1: **afbe** (4 hs)
M2: **dhcge'** (5 hs)

Solution 2: 4 hs
(repeating some tests)

M1: **afce** (4 hs)
M2: **acge** (4 hs)
M3: **dhbe** (4 hs)

Assuming the above Digraph,
parallelize from initial state

Current minimum time: 9 hs (**afbhcgede'**)

References

- Read the paper:

Graph Theory Techniques in Model-Based Testing, by Harry Robinson (Presented at the 1999 International Conference on Testing Computer Software)

- If you are interested you can visit the [Chinese Postman Algorithm by Harold Thimbleby](#) homepage. It contains an implementation and a paper describing it