Activity Diagrams: A Graphical Model for Processes

Lecture 5
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Slides created by
Prof Amir Tomer
tomera@cs.technion.ac.il

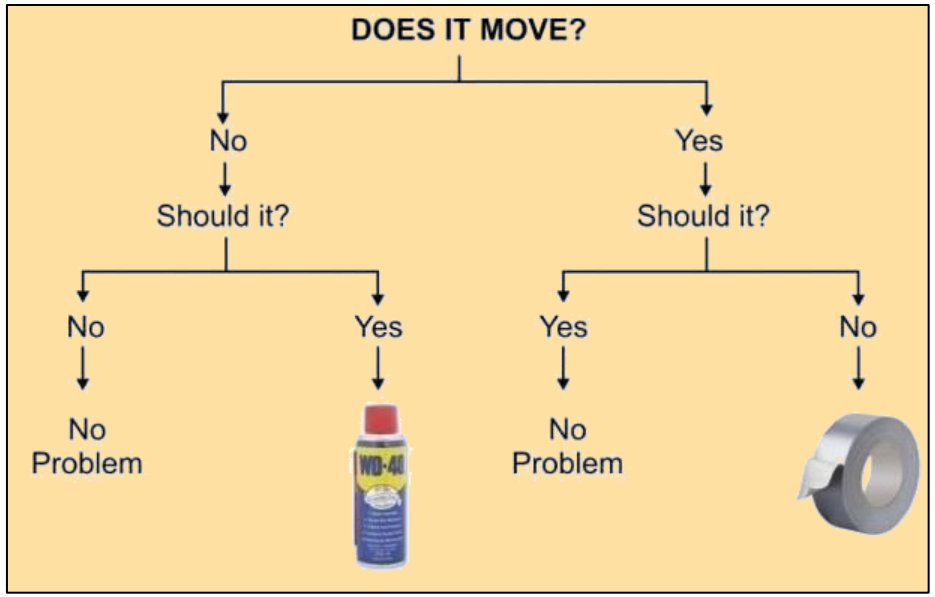


Image source: https://www.sideburnmagazine.com/post/2019/07/11/engineering-flow-chart

In Class Assignment

- Write the Use Case details for the following ePark use cases
  - Register and Check In
  - Enter park attraction
  - Monitor attraction
- Use the format in the slides for the Use Case details
- Change or improve your Use Case Diagram
  - Add <<include>> and <<extends>> as appropriate

ePark Use Case List (Sample Solution)

זיהוי	שם התרחיש	שחקנ/ים ראשי/ים	תיאור קצר של התרחיש
SUC-1	Register and Check-in	Guardian	הכנסת הילד לפארק, מסירת פרטים, פתיחת כרטיס אלקטרוני וחשבון מלווה וקבלת צמיד
SUC-2	Manage eTicket	Guardian	רכישה וביטול של כניסות למתקנים
SUC-3	Park Check-out	Guardian	סגירת חשבון והחזרת הצמיד
SUC-4	Track Child	Guardian	מעקב שוטף אחר מיקומו של הילד בפארק
SUC-5	eTicket Update	Spontaneous	עדכון הכרטיס האלקטרוני כחלק מתהליכים אחרים (included UC)
SUC-6	Enter Park Attraction	Child	כניסה למתקן שעשועים בכפוף להרשאות ולמגבלות
SUC-7	Exit Park Attraction	Child	יציאה ממתקן שעשועים לאחר סיום השימוש או כתוצאה מתקלה
SUC-8	Setup Attraction	Supervisor	קביעת ההגדרות והמגבלות של מתקן שעשועים
SUC-9	Monitor Attraction	Supervisor	מעקב שוטף אחר פעולת המתקנים וביצוע פעולות הפעלה/הדממה בהתאם לצורך
SUC-10	Attraction Breakdown	Spontaneous	השבתת מתקן וביצוע הפעולות הנדרשות כתוצאה מתקלה
SUC-11	Start Up	Supervisor	בדיקת תקינות הפארק ואיתחול פעילותו
SUC-12	Shut Down	Supervisor	כיבוי כל מתקני הפארק והפסקת פעילותו

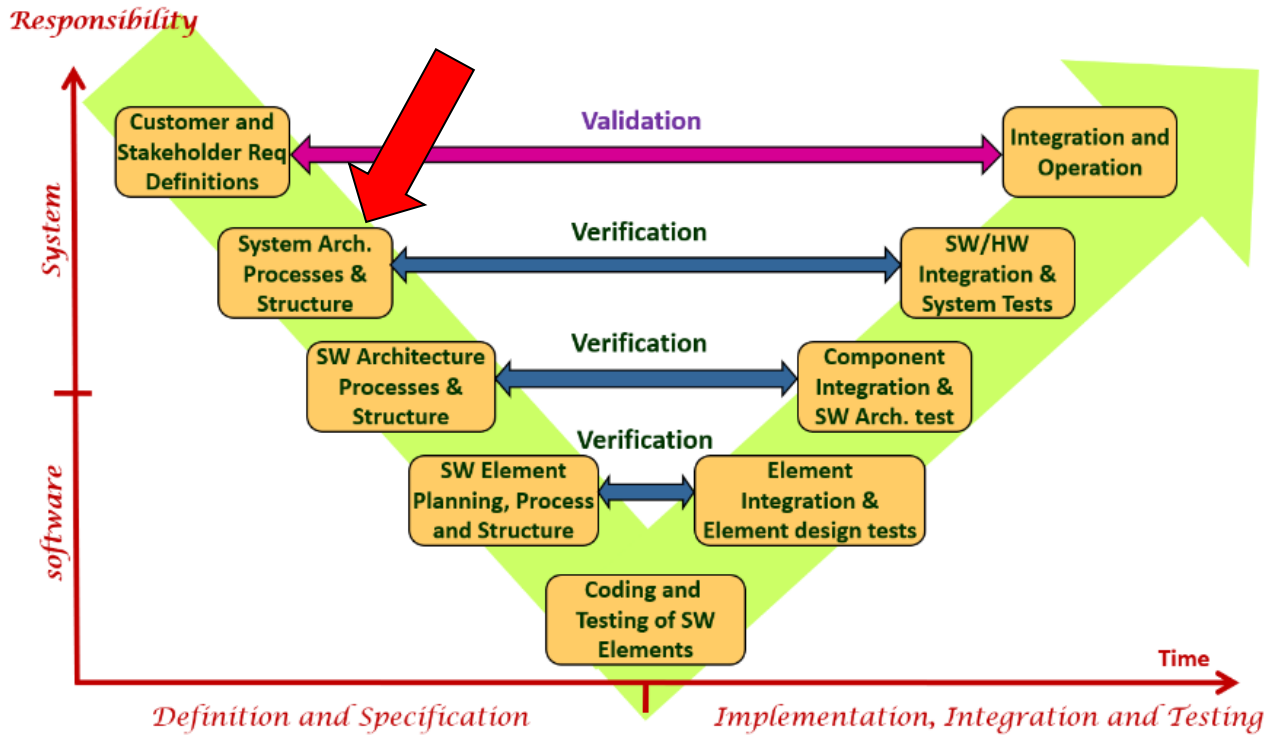
Topics for today

- Activity diagrams

Activity Diagrams model system processes

[System architecture: Processes]

- Our goal: Graphically specify system processes
- Inputs:
  - Technical specification
  - Operational specification
  - Requirements table
  - System process list
- Outputs:
  - Activity diagrams for system processes



Describing use cases with activity diagrams

- Activity diagrams graphically display how a use case proceeds
- Result is a different perspective:
  - Use case text: interaction centric – how the users see things
  - Activity diagrams: process flow centric – how the system sees things
- Put MSS and all branches in ONE activity diagram
- Use “swim lanes” to demarcate roles

- Note: The activity diagram only replaces the trigger, MSS, and branches
  - Rest of the use case (actors, stakeholders, pre-conditions, post-conditions, trackback) remains text!

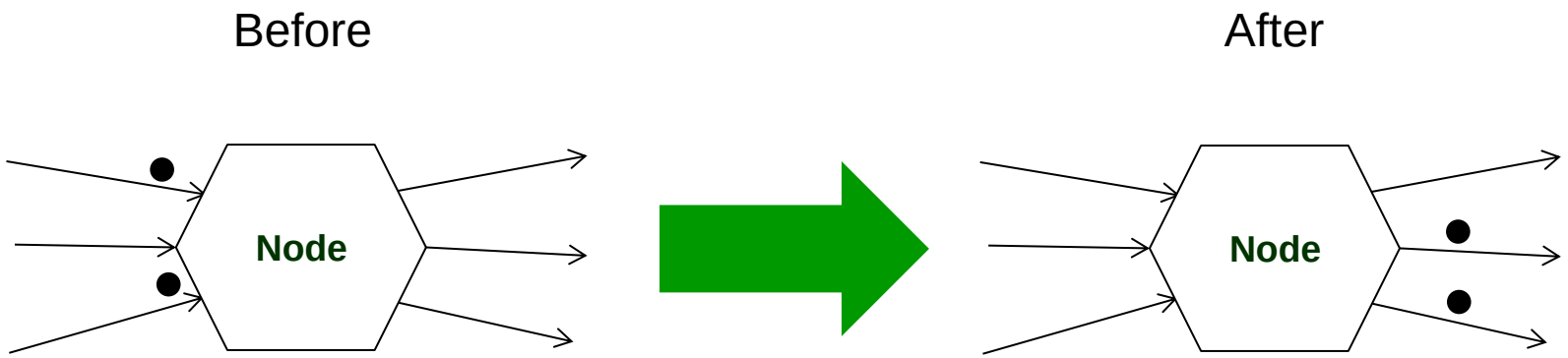
Adding an activity diagram

Use Case ID	Use Case name (choose an operation and subject, e.g. “flying the plane”)
Actors and Goals	Primary actor(s): What are their goals in performing the use case, or “Spontaneous” Supporting actor(s): What are their roles in the use case
Stakeholders and Interests	The stakeholders who have a specific interest in the use case, list their interests
Pre-conditions	Conditions and basic assumptions that must hold to perform the UC. Ensure the conditions can be only true or false!
Post-conditions	Results of a successful UC run from the perspective of the primary actor(s). Write unambiguous, true or false statements.
Trigger	Activity Diagram
Main Success Sequence (MSS)	
Branch #	
Requirements trackback	Operational requirements: that correspond to the use case Other related requirements: Data requirements that connect to data in the use case Non-functional requirements that affect the use case implementation

Activity Diagram

- UML diagram for process flow
- Composed of nodes and uni-directional connecting arrows
- Works by “passing tokens”
  - Tokens pass over arrows
  - Every node consumes or create tokens
  - Each node type has rules about how it processes tokens
  - A node can “operate” when it has enough tokens on its inputs
  - The node consumes that tokens on its inputs and works
  - When done, the node produces output tokens in accordance with its behavior

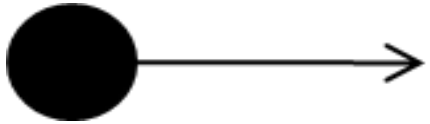
Activity Diagram



Activity diagram: Nodes and operations

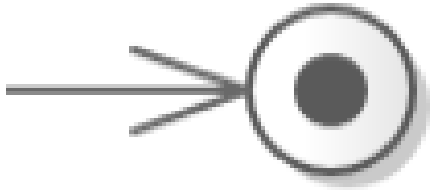
Activity or action

- 1 entrance, 1 exit
- Node words when it has an entry token
- Consumes the token when it starts
- Produces one token when done



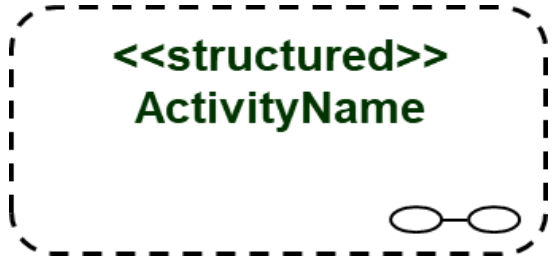
Activity Initiation

- 0 entrance, 1 exit
- Produces one token when done



Flow end

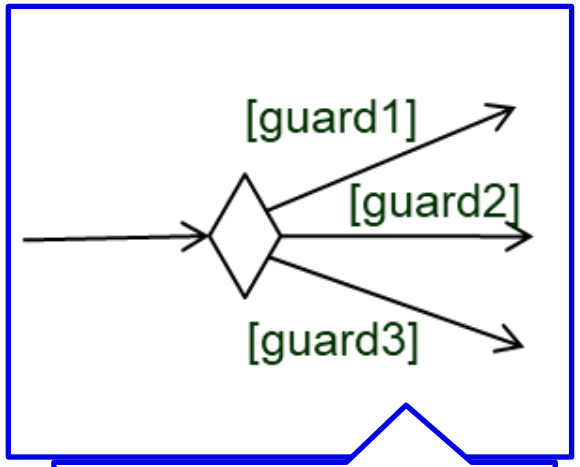
- 1 entrance, 0 exits
- When it works, the activity in the diagram stops
- Flow final/Final are similar



Structured activity

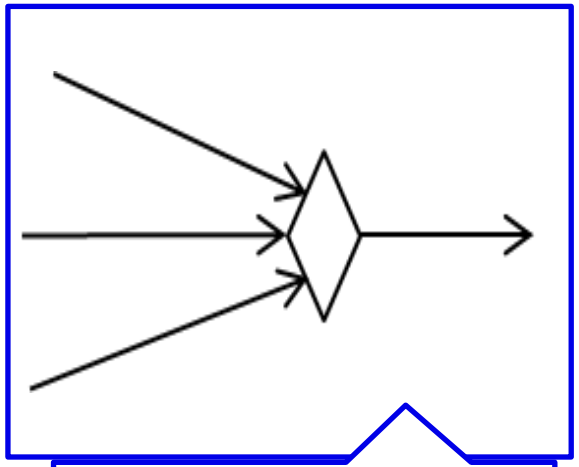
- Leads to another activity diagram
- Types: <<conditional>>, <<sequential>>, <<loop>>

Activity diagram: Control Nodes



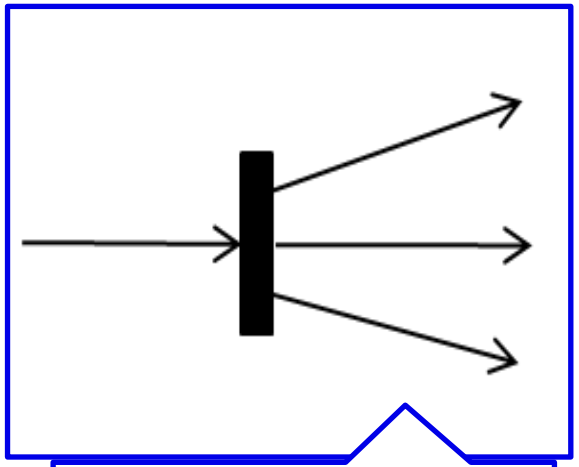
Decision

- 1 entrance, 1+ exits
- Works when a token is by its entrance
- Node consumes the token to work
- Produces one token on one of its exits based on the guard (XOR)



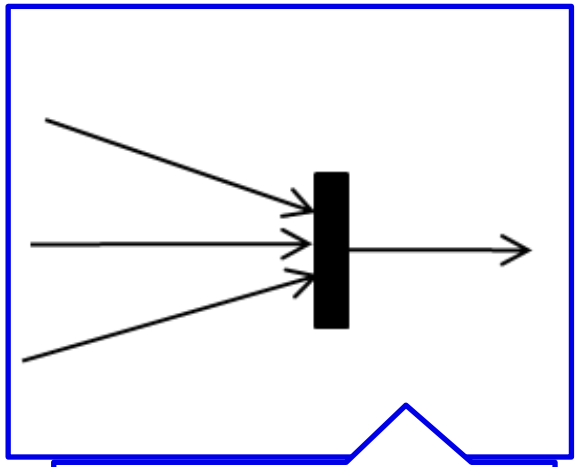
Merge

- 1+ entrances, 1 exit
- Works when a token is found on one of its inputs (OR)
- Node consumes the token to work
- Produces one token on its exit



Fork

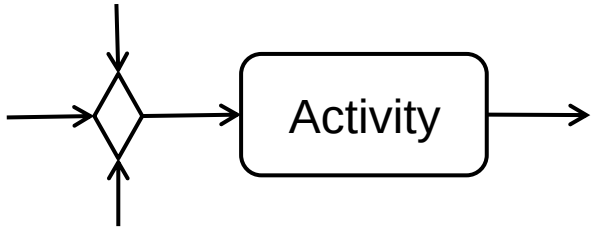
- 1 entrance, 1+ exits
- Works when a token is found on its entrance
- Node consumes the token to work
- Produces tokens on all of its exits (AND)



Join

- 1+ entrances, 1 exit
- Works when a token is found on all its entrances (AND)
- Node consumes all the tokens to work
- Produces one token on its exit

Shorthand conventions



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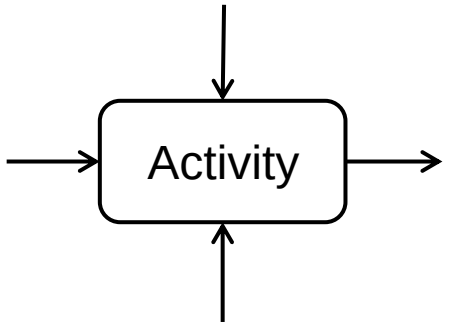

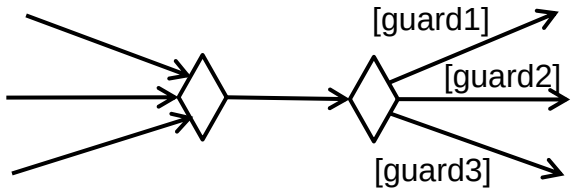

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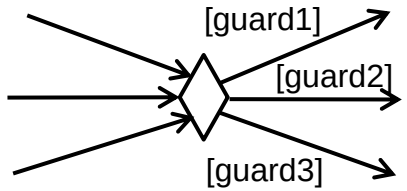

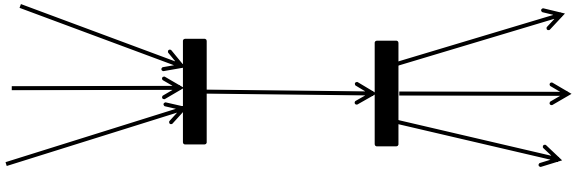

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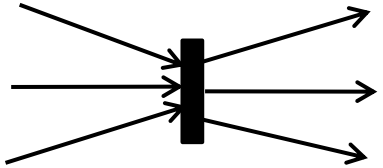
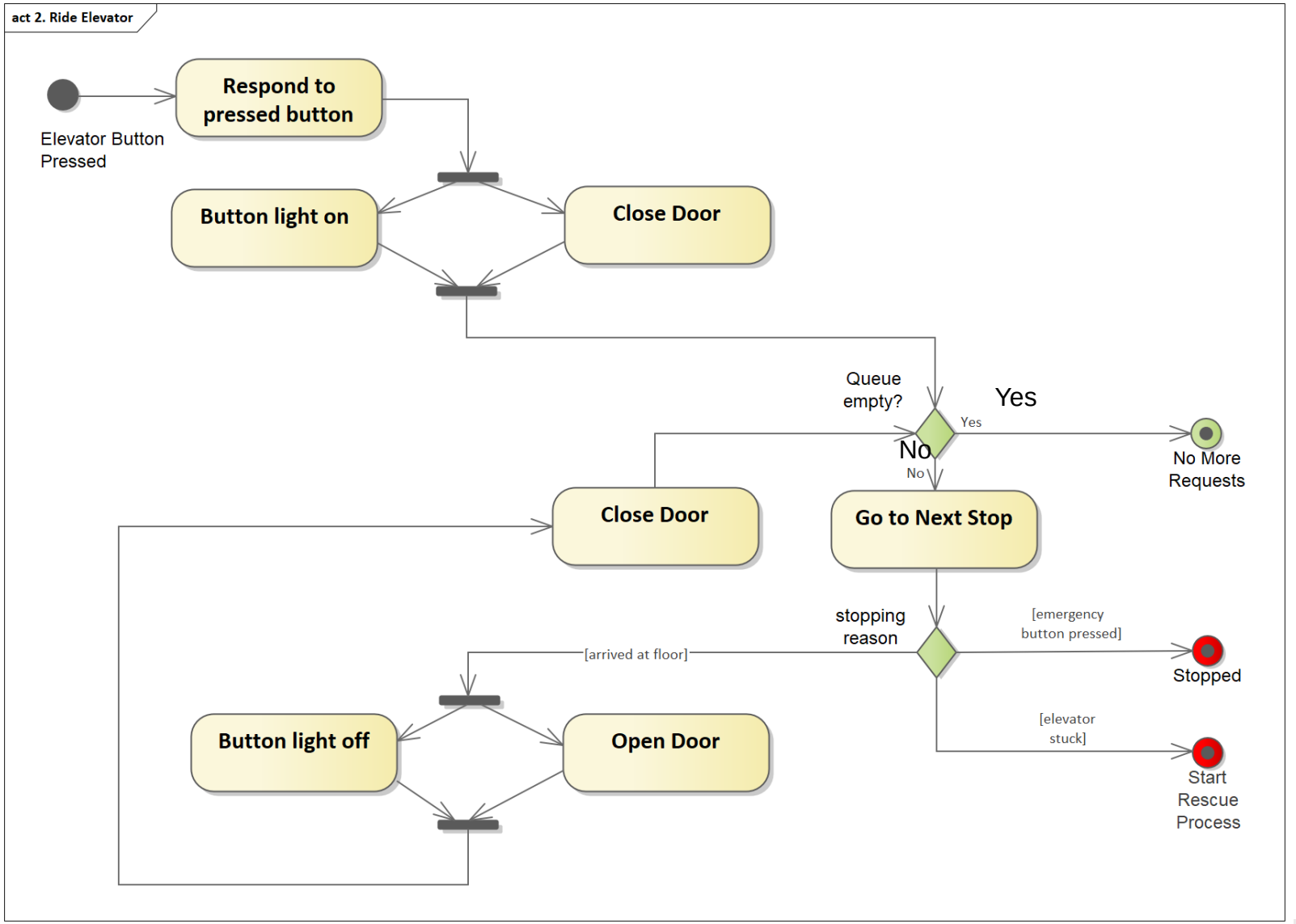
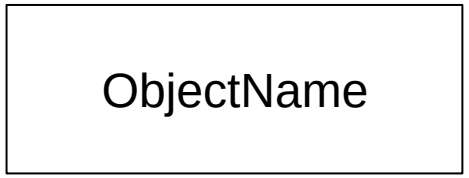


SUC-2 Ride elevator – Activity Diagram



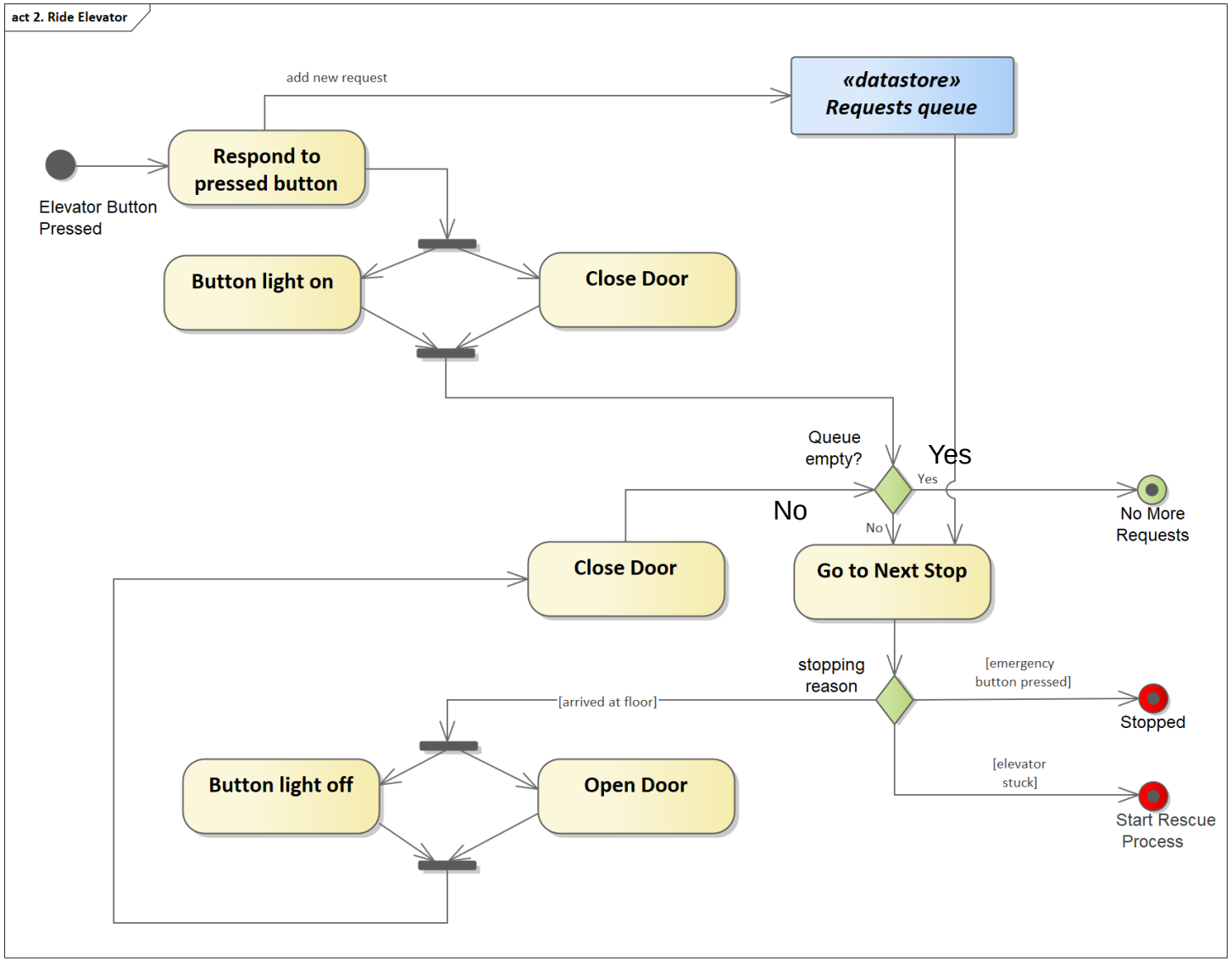
Data flow in an Activity Diagram

- In addition to control flow, you can show data flow between activities
  - Object: Data item, input or output of an activity

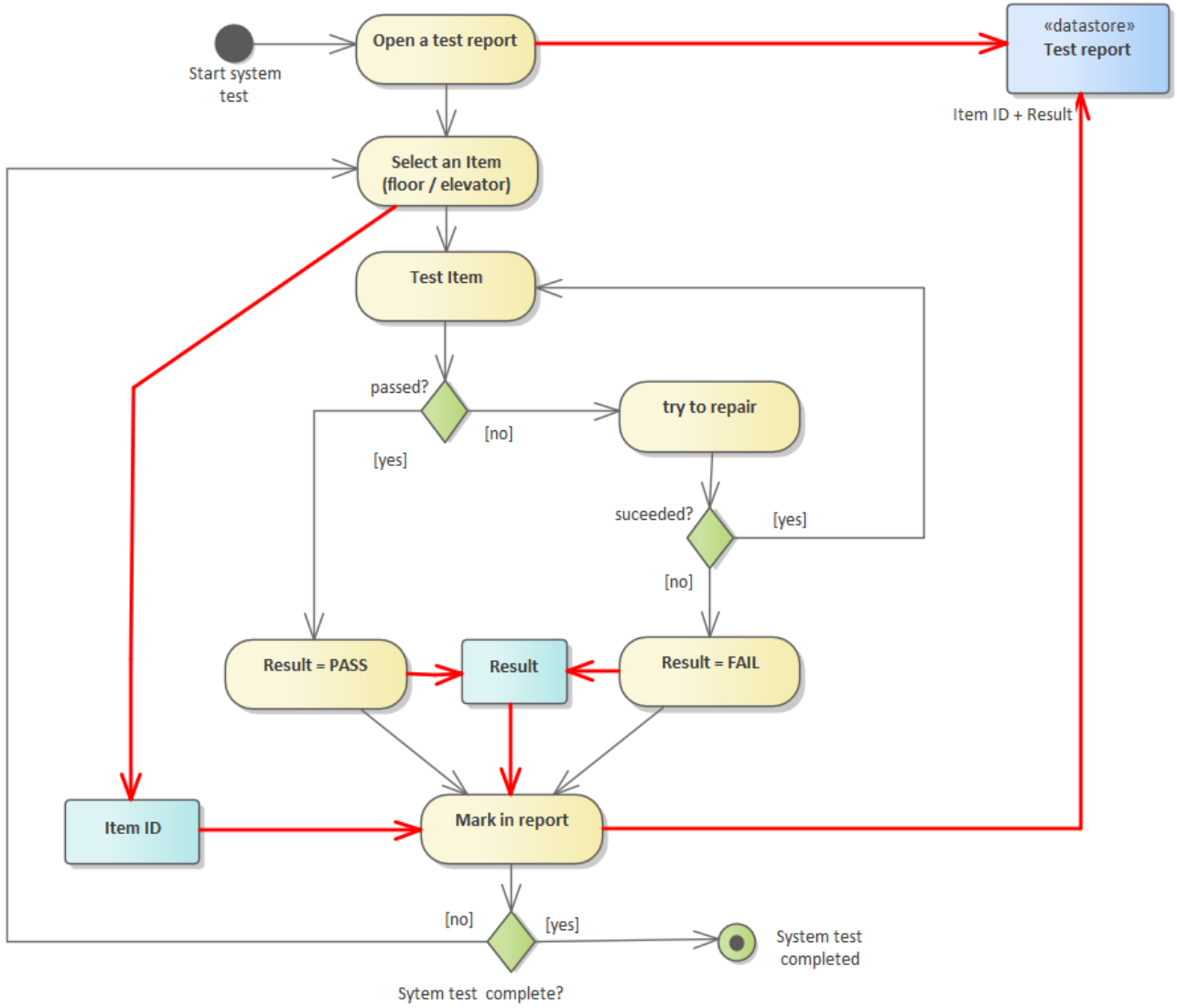


  - Data store: Activities can store or read data items

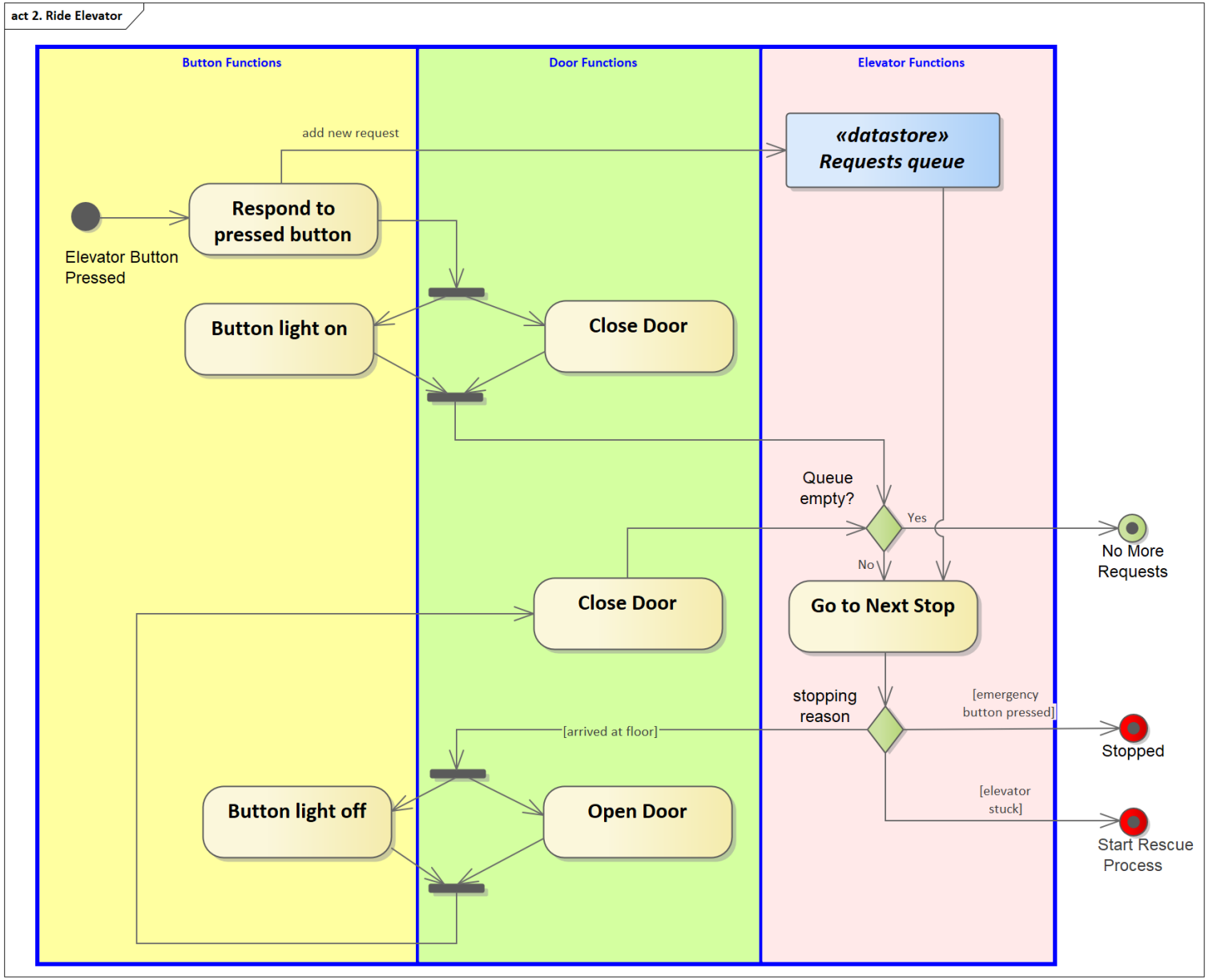
SUC-2 Ride elevator – Activity Diagram with Data Flow



SUC-4 System test – Activity Diagram with Data Flow



Activity Assignment Using Swim Lanes



In class activity: Activity Diagrams for Use Cases

- Create activity diagrams for the following use cases:
  - Enter an attraction
    - Include control flow and data flow
  - Track child
    - With the following swim lanes:
      - Central Database
      - Guardian (parent) Work-Station
      - Bracelet

Conclusion

- Activity diagrams