8 – when there are multiple starts, a common start node can be used to indicate the beginning of a project on a network. Similarly, single project end node can be used to indicate clear ending

## **Activity-On-Node (AON) Fundamentals**

- 2 methods used to develop project networks
  - AON Activity-on-node (activity is shown on node/rectangle)
    - 3 basic relationships for activities
      - Predecessor activities before
      - Successor activities after
      - Concurrent/parallel activities during

0 A 10

Define

15

15

30 20 50

TS = 0

35

70 15 85

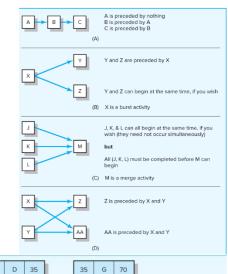
TS = 35

50

Assign

25 5 30

AOA – Activity-on-arrow (activity is shown on arrow)



15

50

35 85

85

0

85 15

TS = 0

Н

Legend

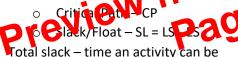
ID

Descriptio

DUR LF

## **Network Computation Process**

- Forward pass earliest times
  - Early start (ES) = largest EF of predecessors
  - o Early finish (EF) = ES + DUR
  - Expected time (TE)
- Backward pass Latest times
  - Late start LS = LF DUR
  - Late finish LF = smallest to 0 successors



delayed without affecting project duration

- $\circ$  TS = LS ES
- $\circ$  TS = LF EF
- Negative slack is when critical path is delayed
- Sensitivity function of number of critical paths or near-critical paths
  - o Insensitive network schedule has 1 CP and noncritical activities with significant slack

Automated Warehouse Order Picking System

- Sensitive 1+ CP and noncritical activities with very little slack
- Free Slack/Float (FS) max time activity can be delayed from ES without affecting ES of any successor(s)
  - Can never be negative
  - Only activities at end of chain (merge activities) can have free slack

## **Practical Considerations**

- Activity numbering
  - Activities can have gaps between their ID numbers to add missing/new activities later
- Gantt charts are used during planning, resource scheduling and status reporting
  - o Extended lines from bars represent slack
  - o Bar indicates ES, EF, LF, slack