

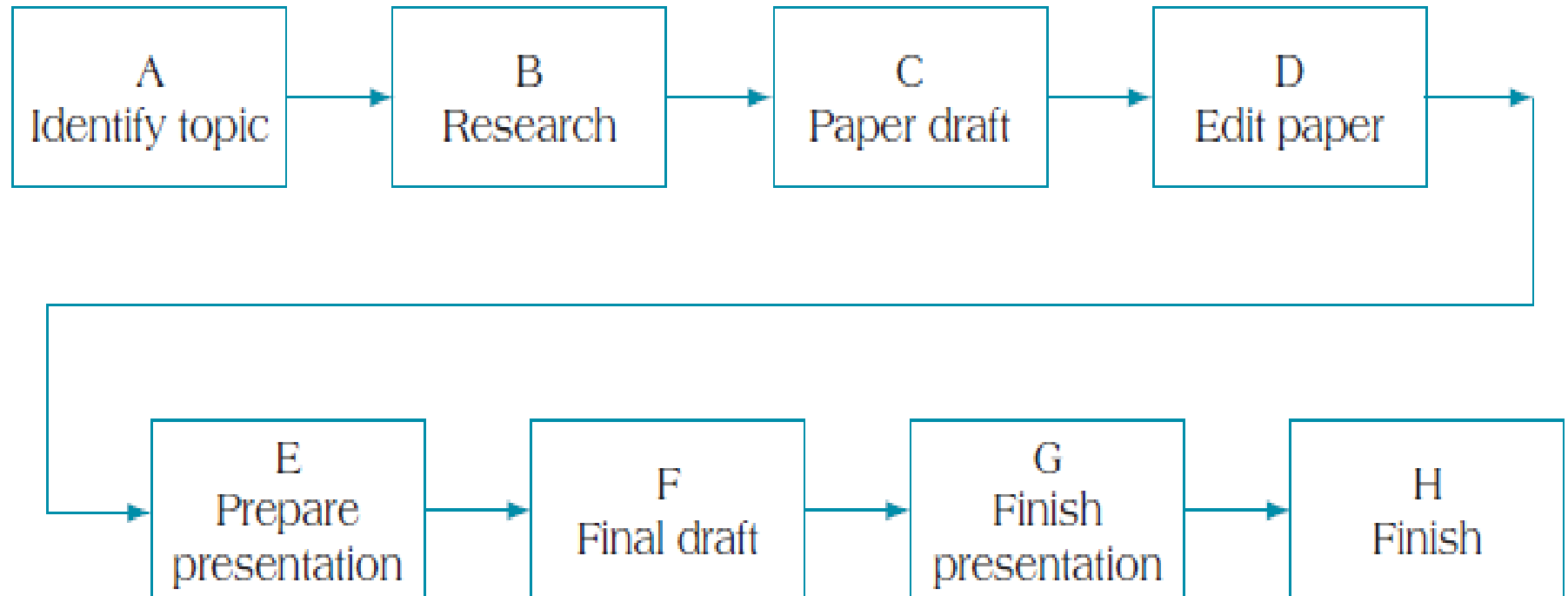
# Project Scheduling: Networks, Duration estimation, and Critical Path

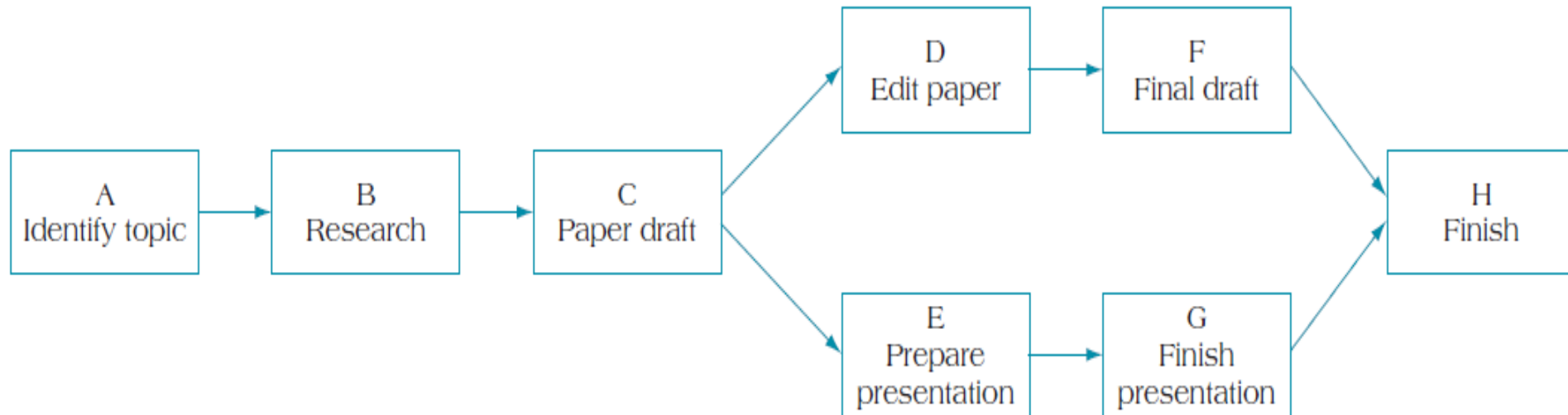
# Course Structure

- Introduction
- Projects and Strategy
- Project Selection and Portfolio Management
- Project Cost Estimation and Budgeting
- Project Scheduling: Lagging, Crashing and Activity Networks
- **Project Scheduling: Networks, Duration estimation, and Critical Path**
- **Risk Management**
- **Resource Management**
- **Project Evaluation and Control**
- **Agile Project Management**
- **Critical Chain Project Scheduling**

# Network diagram

- A schematic display of the project's sequential activities and the logical relationships between them





# A network...

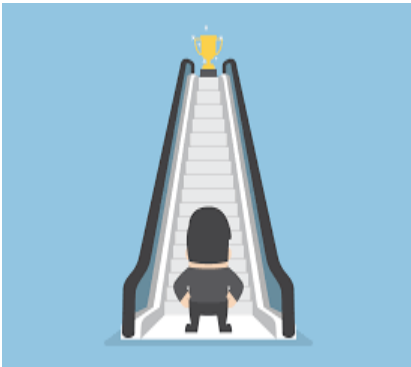
- clearly illustrates the interdependence of all tasks
- facilitates communication flows
- helps with allocating organizational resources
- identifies the critical activities
- determines when you can expect projects to be completed
- shows when various project activities must start and end

# Key Scheduling Terminology

- **Path**—A sequence of activities defined by the project network logic.
- **Event**—A point when an activity is either started or completed.
- **Predecessors**—Those activities that must be completed prior to initiation of a later activity in the network.
- **Successors**—Activities that cannot be started until previous activities have been completed.
- **Critical path**—The path through the project network with the longest duration.

# Rules of thumb

1. Determination of activity precedence ordering must be done prior to creating the network
2. Network diagrams usually flow from left to right
3. An activity cannot begin until all preceding connected activities have been completed
4. Arrows on networks indicate precedence and logical flow
5. Each activity should have a unique identifier associated with it
6. Looping, or recycling through activities, is not permitted
7. it is common to start a project from a single beginning node



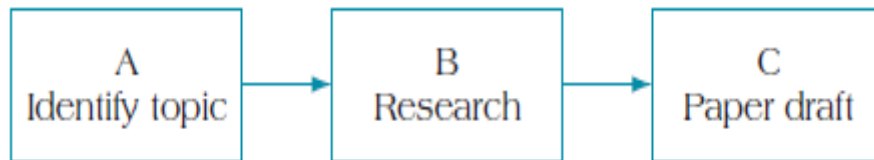


# Labeling Nodes

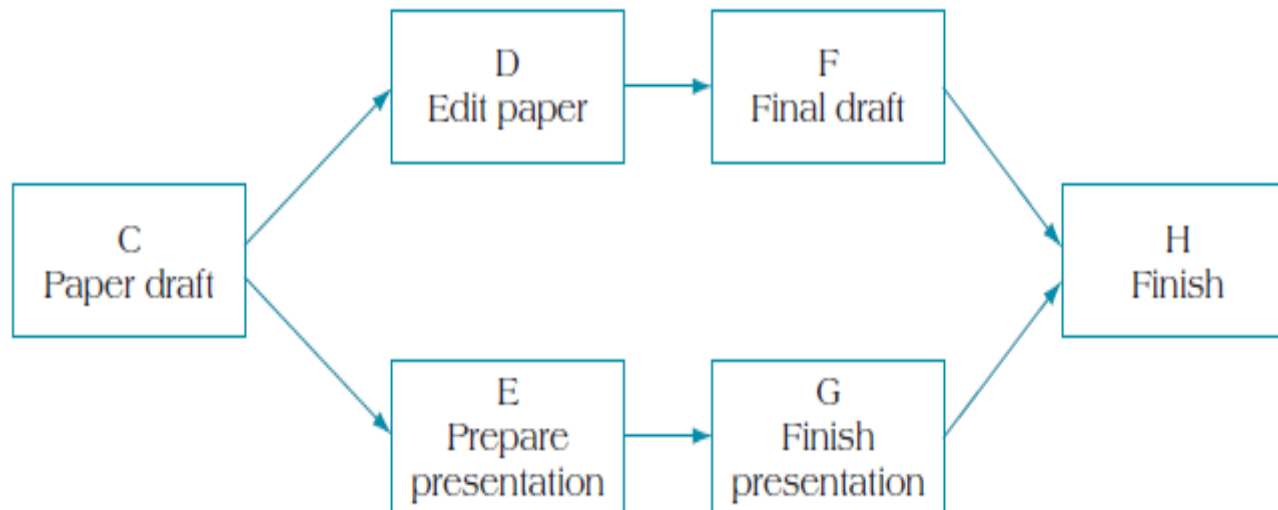
Early start	Identifier number	Early finish
Activity float	Activity descriptor	
Late start	Activity duration	Late finish

# Sequence of activities

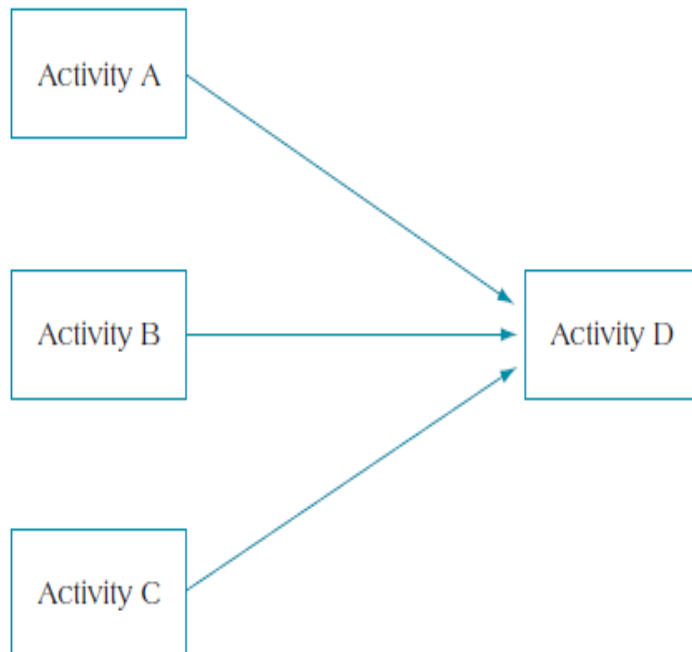
## Serial Activities



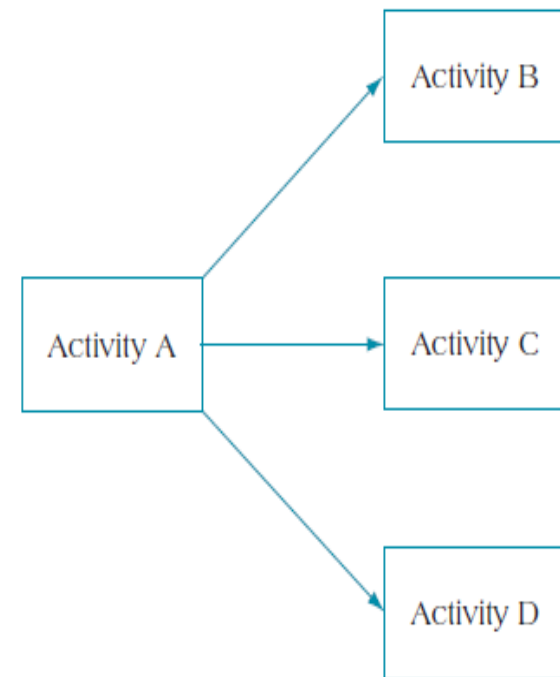
## Concurrent Activities



## Merge Activities



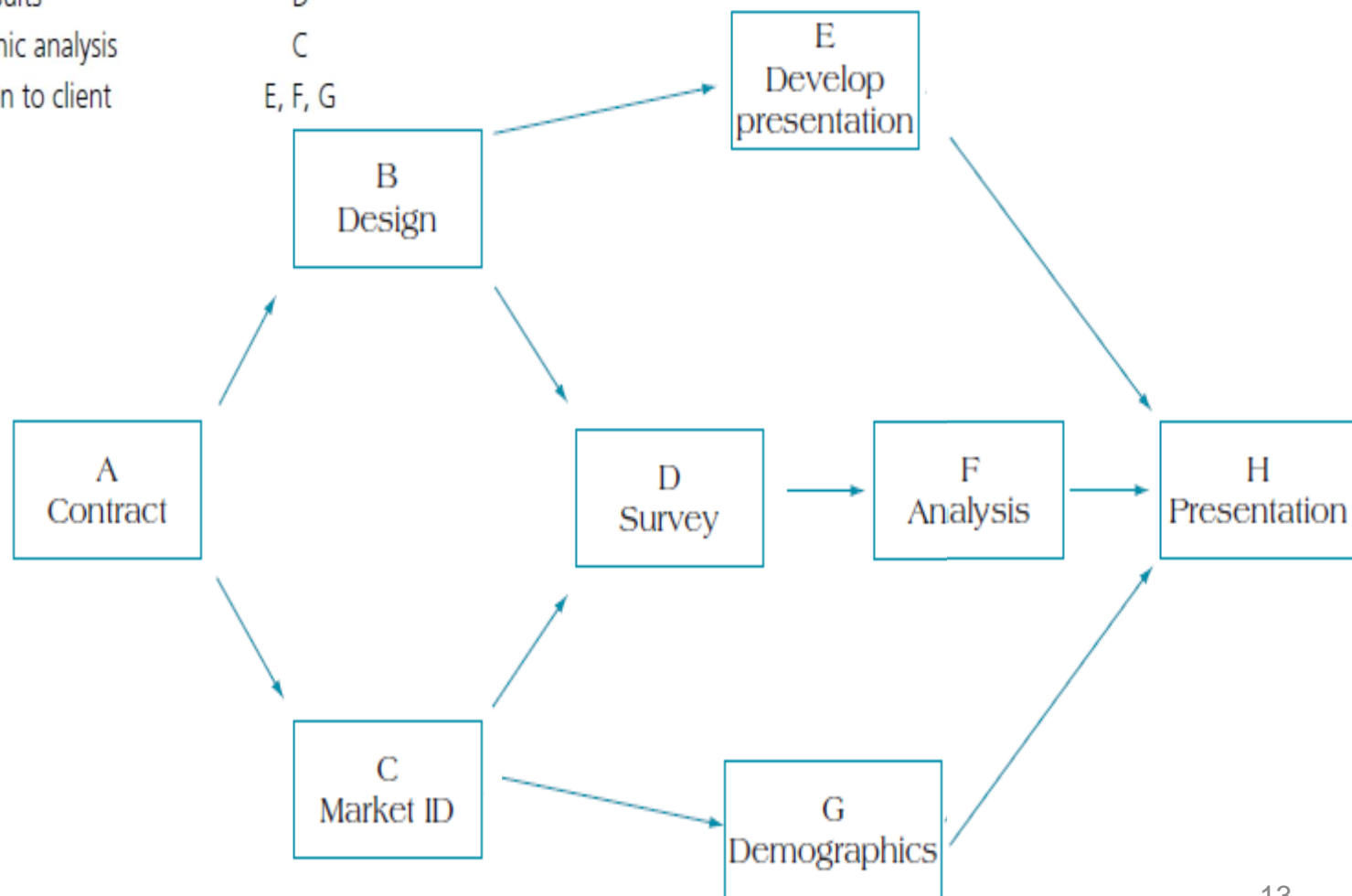
## Burst Activities



# Example

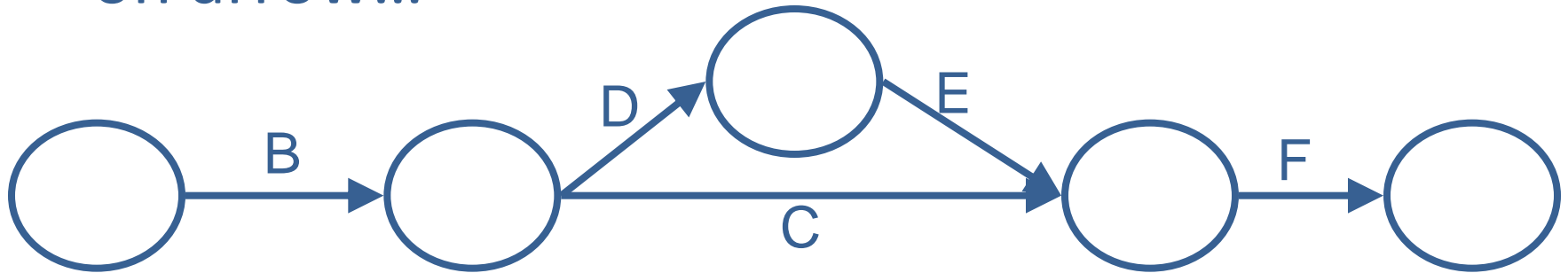
Activity	Description	Predecessors
A	Contract signing	None
B	Questionnaire design	A
C	Target market ID	A
D	Survey sample	B, C
E	Develop presentation	B
F	Analyze results	D
G	Demographic analysis	C
H	Presentation to client	E, F, G

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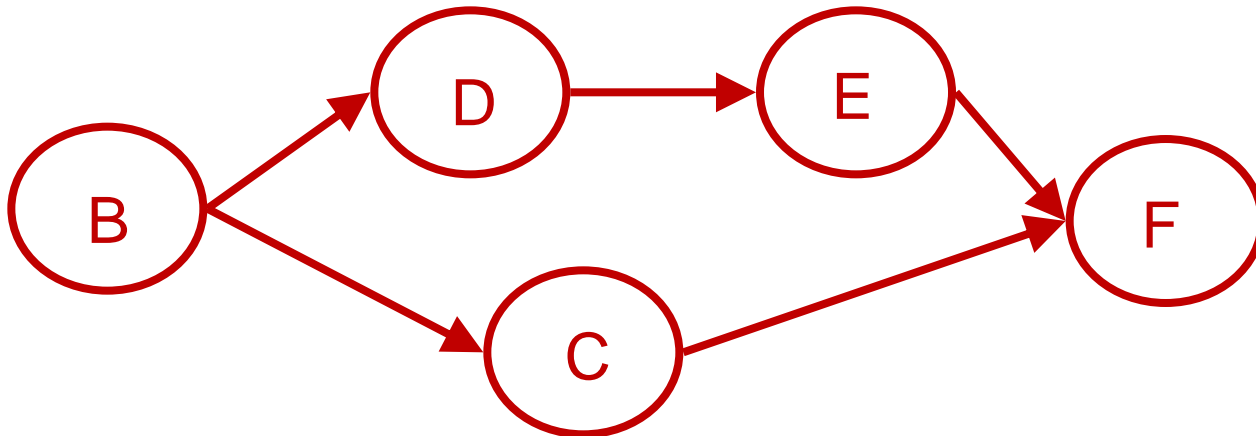


# AOA vs. AON

The same mini-project is shown with activities on arrow...



...and activities on node.



# Node Labels

Early Start	ID Number	Early Finish
Activity Float	Activity Descriptor	
Late Start	Activity Duration	Late Finish

# Duration Estimation Methods

- Past experience
- Expert opinion
- Mathematical derivation – Beta distribution
  - Most likely (m)
  - Most pessimistic (b)
  - Most optimistic (a)

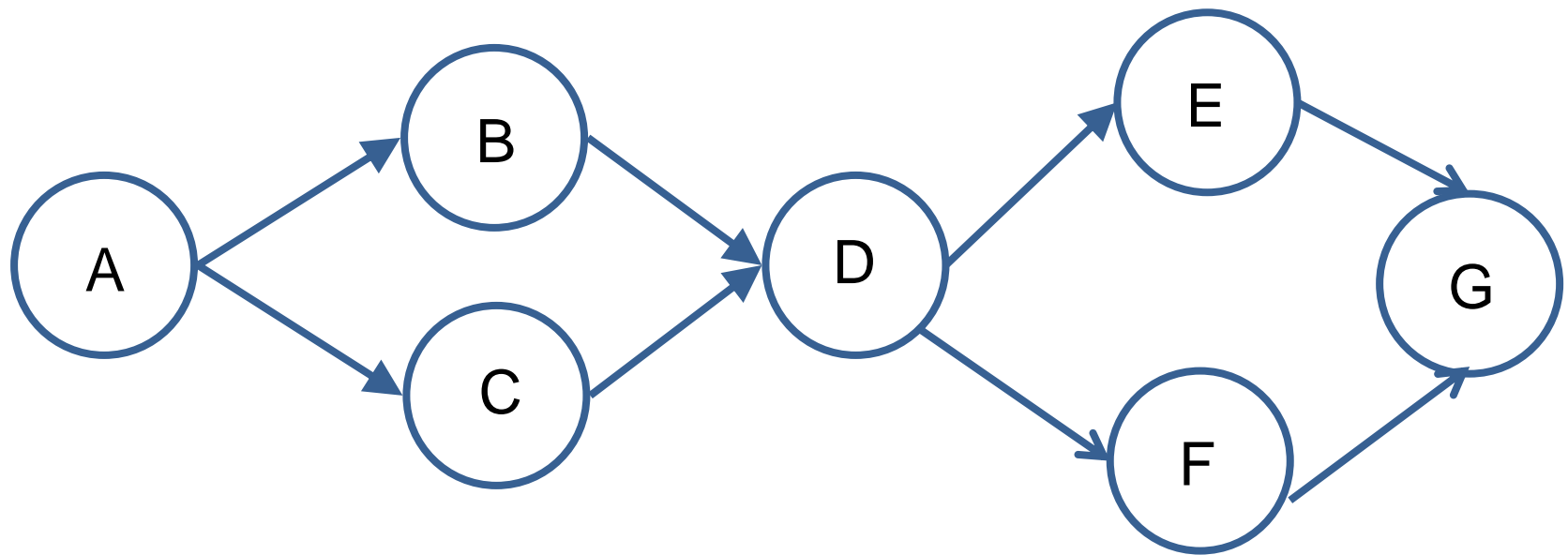
$$\text{Activity Variance} = s^2 = \left( \frac{b - a}{6} \right)^2$$

$$\text{Activity Duration} = \text{TE} = \frac{a + 4m + b}{6}$$



1. Sketch the network described in the table.
2. Determine the expected duration and variance of each activity.

Task	Predecessor	a	m	b
A	--	7	8	15
B	A	13	16	19
C	A	14	18	22
D	B, C	12	14	16
E	D	1	4	13
F	D	6	10	14
G	F, E	11	14	19



Task	Predecessor	a	m	b	Var.	TE
A	--	7	8	15	1.78	9
B	A	13	16	19	1	16
C	A	14	18	22	1.78	18
D	B, C	12	14	16	0.44	14
E	D	1	4	13	4	5
F	D	6	10	14	1.78	10
G	F, E	11	14	19	1.78	14.3

Critical Path .....

**Next Lecture**