

Mongolian Management Training Program

- Project Management
- Critical Path Method (CPM)

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- 2016

Project Planning

- The lowest level but most detailed level in an overall planning system.
- Deals with a set of deterministic activities that leads to the completion of a specific project, within a particular time frame.
- Historical development of various techniques of Project Planning:
 1. Ganth Chart, or Bar Chart
 2. Mile-stone chart
 3. Network Diagramming:
 - **PERT**, Program Evaluation and Review Technique
 - **CPM**, Critical Path Method
 - **PDM**, Procedure Diagramming Method
 - **GERT**, Graphical Evaluation and Review Technique

Network Principles

- Formats
 - **AIB** (Activity in the Box) or **AON** (activity on node): Each activity is represented by a box in the network diagram, and is assigned a number.
 - **AOA** (Activity on the Arrow): Each activity is represented by an arrow, the tail of the arrow designates the start of the activity and the head represent the completion of the activity.
- In the AOA format, activities are linked by circles, called “events”.
- An **Event** represents the finish of activities entering into it and the start of activities going out of it. It is an instant of time marking the start or the accomplishment of an activity. It cannot be considered accomplished until all activities leading to it have been accomplished.
- An **Activity** is the work required to accomplish an event.

Precedential Relationships

- Networks are consisted of a series of interrelated activities in which some must be finished before others can start.
- Dummy activities: In AOA format, it represents precedential relations without taking any time, and is shown as dashed arrows.
- Laddering: Some projects have a set of activities that are repeated several times. (painting of several rooms, 1st coat, 2nd coat, trim). Instead of repeating them sequentially, they are shown like ladder.

Planning Process

- Define Objectives
- Determine activities and their interrelations
- Prepare network diagrams
- Time estimations
- Budgeting
- Implementation
- Monitoring and revisions

Define Objectives

- The expected results or end product must be:
 - clearly defined and agreed upon by the customer and the organization,
 - should be attainable, specific and measurable.
- The objective is defined in terms of scope, time schedule and costs.

Determine Activities

- In smaller projects, activities are determined by brainstorming by the project team. In larger project this is not possible and Work Breakdown Structure approach is used.
- Work Breakdown Structure (**WBS**): WBS breaks down the project into manageable pieces. It is a hierarchical tree of end items that will be accomplished by the project team. Work items are broken into smaller units, shown in different organizational level, the lowest level is called “Work package”. No single way of determining the level of details as it depends on:
 1. the level at which a single individual or organization can be assigned responsibility
 2. The level at which you want to control and monitor.

Responsibility matrix: A tool the shows who has the primary (P) responsibility and who has support (S) responsibility for each item .

Prepare the Network Diagram

- List activities
- Sequence of activities:
 - Which activities must be finished immediately before this activity can start?
 - Which activities can be done concurrently with this activity?
 - Which activities cannot be started until this activity is finished?
- Drawing network:
 - Flow from left to right
- Numbering of events: arbitrary, the number of the head event should be larger than the number of the tail.

Time estimation (tE) of each activity

- Estimated start time and a required completion time for the overall project.
- Duration of each activity: Based on experience, it should be aggressive but realistic. (better to estimate 5 days and finish on the 6th than estimate for 10 and finish in 8).
- three estimates:
 - Optimistic (O), nothing will go wrong
 - Pessimistic (P), many things go wrong
 - Most probable (MP)
- $tE = tO + tP + 4tMP / 6$
- In AIB format, it is shown in the lower right-hand corner of the box, opposite of activity number on the lower left hand corner. Some software use a different place, eg. top centre of the box.
- In the AOA format it is shown under the activity arrow below the name of the primary responsible person's name, on top of arrow is the activity description on the top of the arrow.

Time estimation (continued)

AIB:

- Activity description
- Activity #/responsible person/duration

AOA:

- Activity description, between start and finish event numbers
- Responsible person
- Duration

Example:

Consumer market study: show in AIB and AOA formats

Activities: (sequential (S), parallel (p))

1. Identify target consumers
2. Develop draft questionnaire
3. Pilot-test questionnaire
4. Review and finalize questionnaire
5. Prepare mailing labels (p)
6. Print questionnaire (p)
7. Develop data analysis (p)
8. Develop software test data (p)
9. Mail questionnaire and get responses (linked to 5 & 6, and (P) with 10)
10. Test software (linked to 7 & 8 and (P) with 9)
11. Input response (linked with 9 & 10)
12. Analyze results
13. Prepare report

Start/finish time

- The following times are calculated for each activity.
 - *Earliest Start time (ES)
 - *Earliest Finish time (EF)
 - *Latest start time (LS)
 - *Latest Finish time (LF)
 - *Slack Time (S)
- **Earliest Start time (ES):** Earliest time at which a particular activity can begin.
 - ES for the first activity is zero.
- **Earliest Finish time (EF):** Earliest time by which a particular activity can be completed, calculated by adding the activity's duration estimate (D) to the activities' ES:
$$EF = ES + D$$
- The ES and EF times are determined by calculating **forward**, working from the beginning to the end of project activities.
- Rule: The ES for each activity must be the same or later (largest figure) than the latest of all the EF times of all activities leading directly into the particular activity.
- Example: practice play 5 days, make costumes 10 days, make props 4 days, before dress rehearsal 2 days.

Start/finish time (continued)

- **Latest Finish time (LF):** Latest time by which an activity must be completed in order for the entire project to be finished, calculated on the basis of the project's required completion time and the duration estimates for succeeding activities.
- **Latest Start time (LS):** Latest time by which an activity must be started in order for the entire project to be finished on time, calculated by subtracting the activities duration estimate from the activities finish time:

$$LS = LF - D$$

- The LS and LF are determined by calculating **backward**, by working from the end of the network to the beginning of the project's activity.
- Rule: The LF for a particular activity must be the same as or earlier (smallest figure) than the earliest of all the LS times of all the activities emerging directly from that particular activity.
- The LF for the last activity is equal to EF of that activity.

Start/finish time (continued)

- Slack: The difference between the EF time of the very last activity and the project's required completion time. This is **Total Slack** or Float.

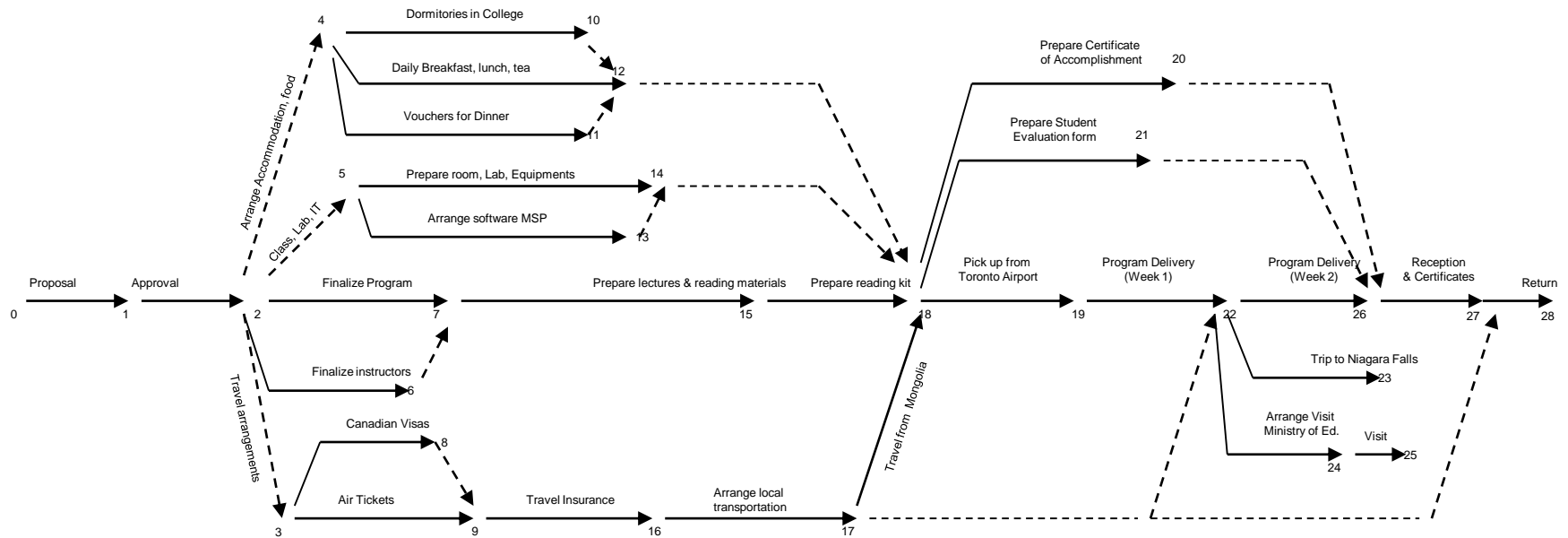
$$\text{Total Slack} = \text{LF} - \text{EF}$$

- The longest (most time-consuming) path is the **critical path**.
- To determine which activities make the critical path is to find which ones have the least slack.
- Free Slack: the amount of time a particular activity can be postponed without delaying the ES time of its immediately succeeding activities.

Process

- Budgeting
- Information system (IS)
- Implementing
- Monitoring and revisions

Plan of Activities for the Mongolian Project Management Program, York University, Atkinson Faculty of Liberal and Professional Studies



3rd week
November 2007

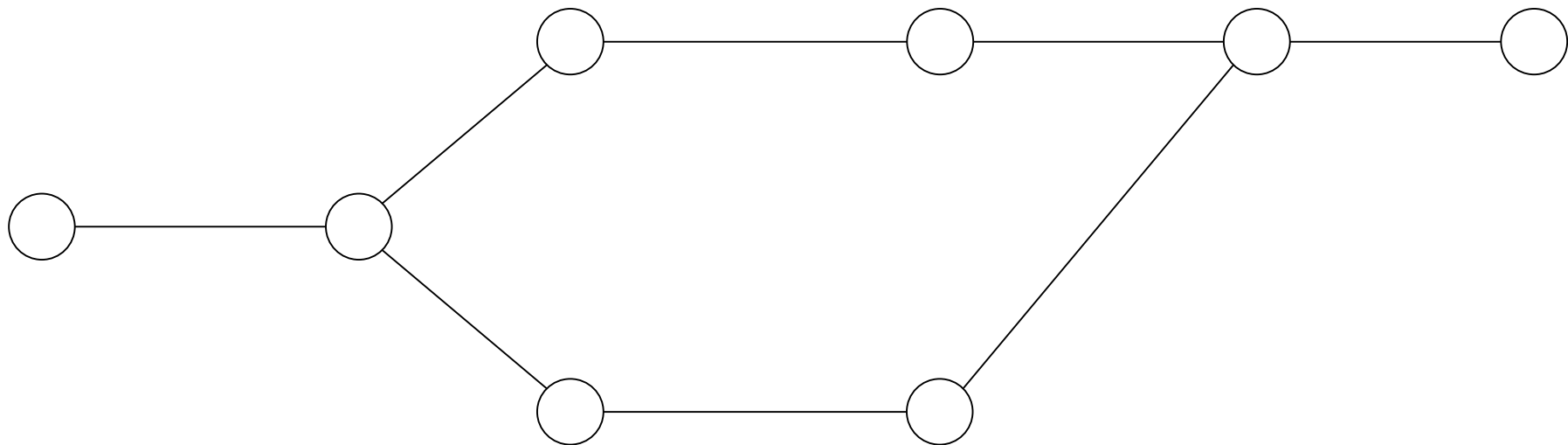
2nd Week
April 2008

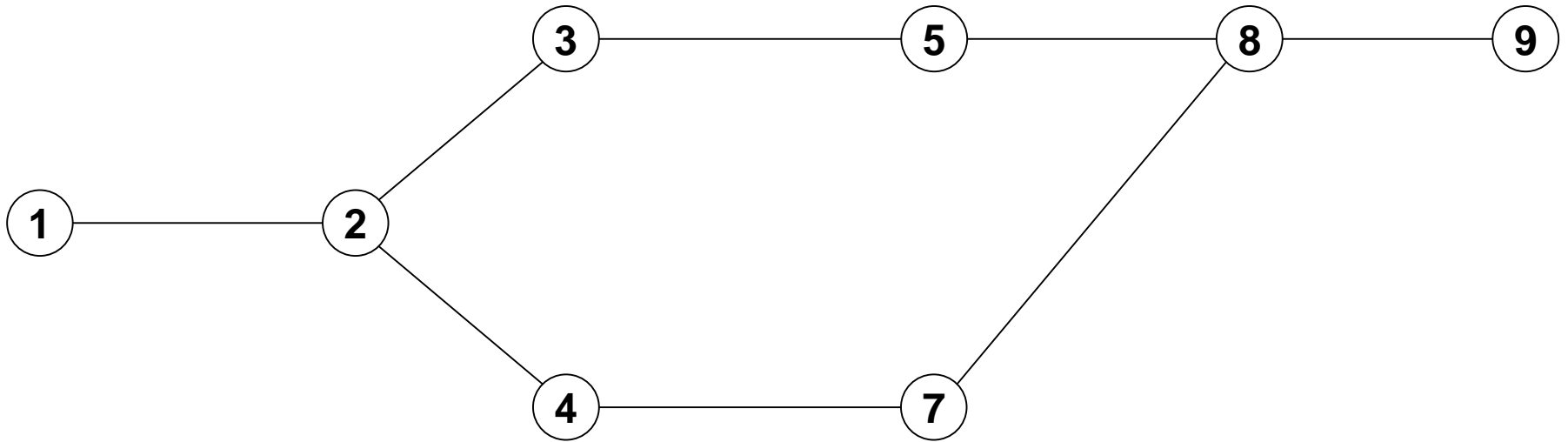
Monday 19
May 2008

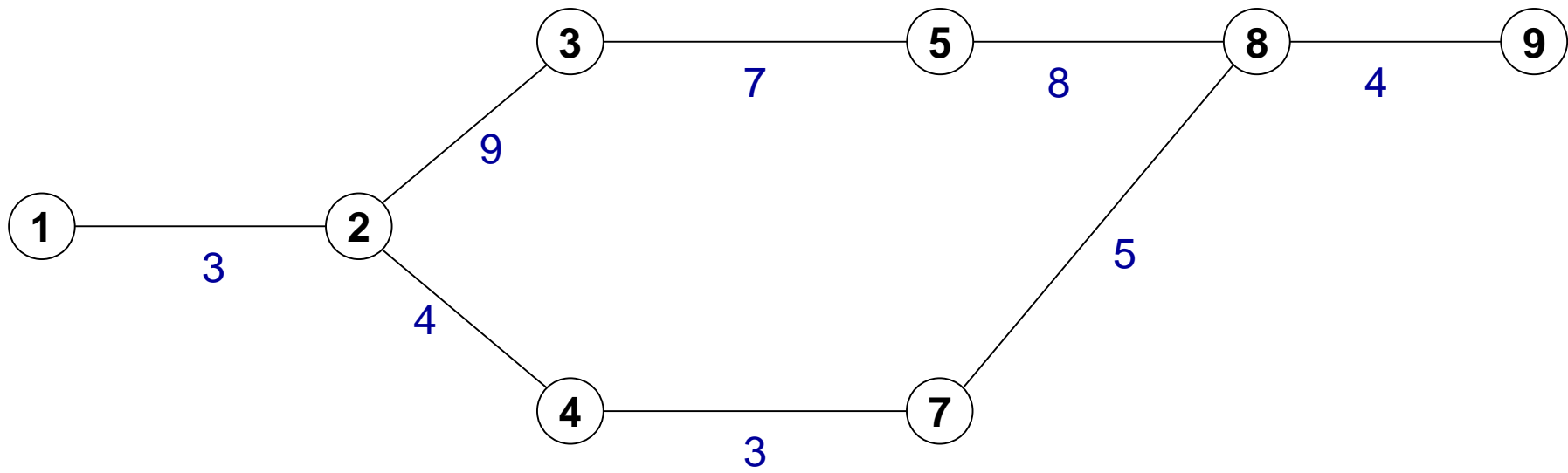
Saturday 24
May 2008

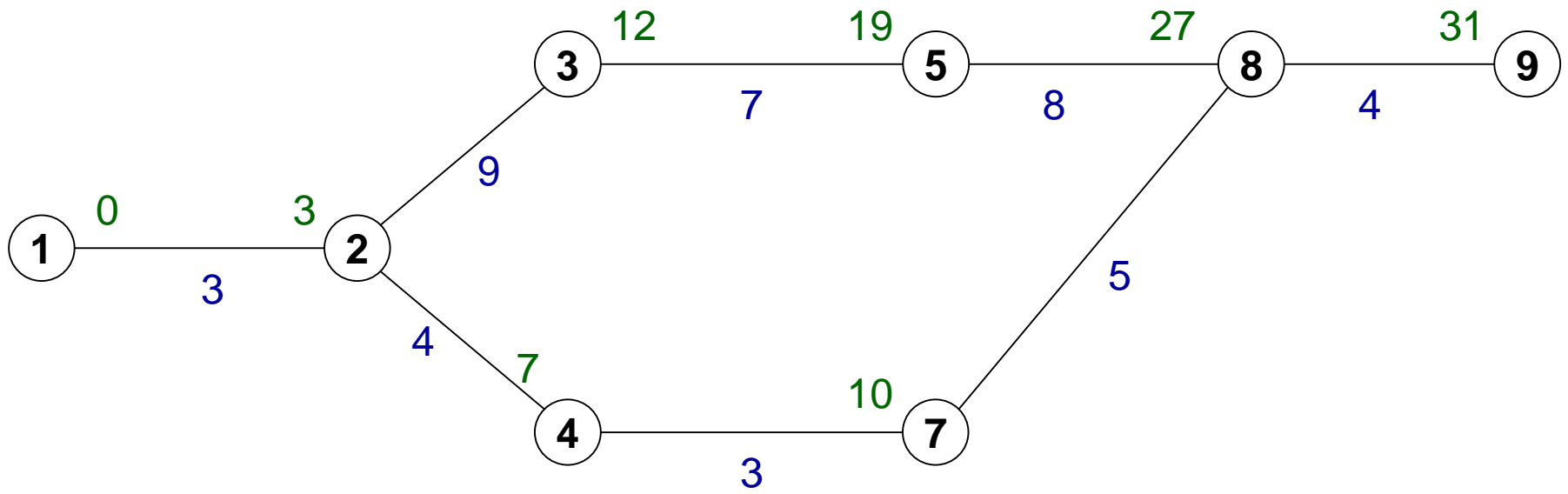
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May 2008

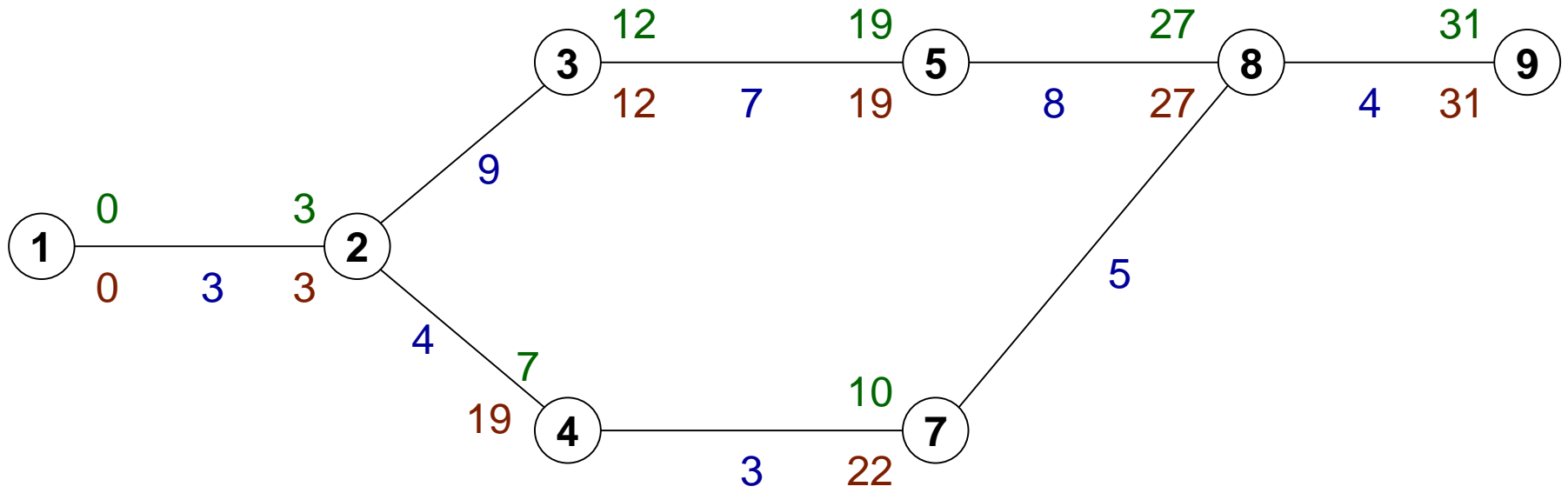
Saeed Rahnema











Summary

Event #	D	ES	EF	LS	LF	Slack
1-2	3	0	3	0	3	0
2-3	9	3	12	3	12	0
2-4	4	3	7	3	19	12
3-5	7	12	19	12	19	0
4-6	3	7	10	19	22	12
5-7	8	19	27	19	27	0
6-7	5	10	27	27	27	17
7-8	4	27	31	27	31	0