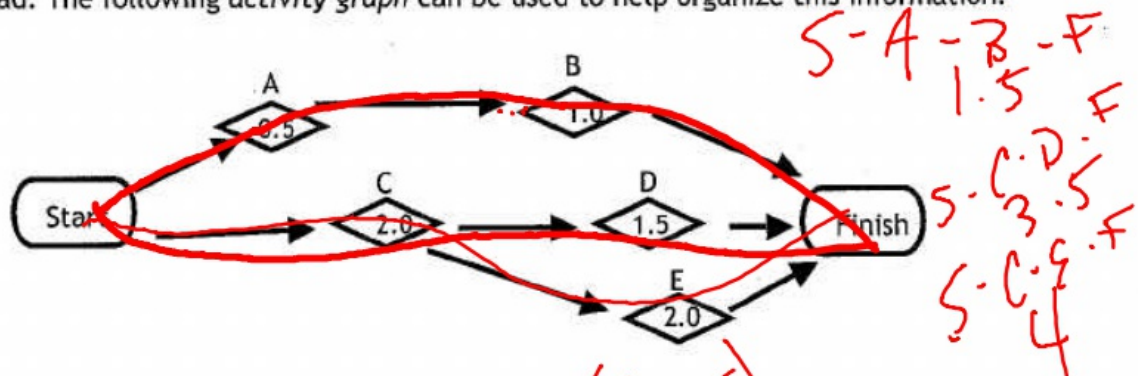# Networks and Graphs: Program Evaluation and Review Technique (PERT) Charts

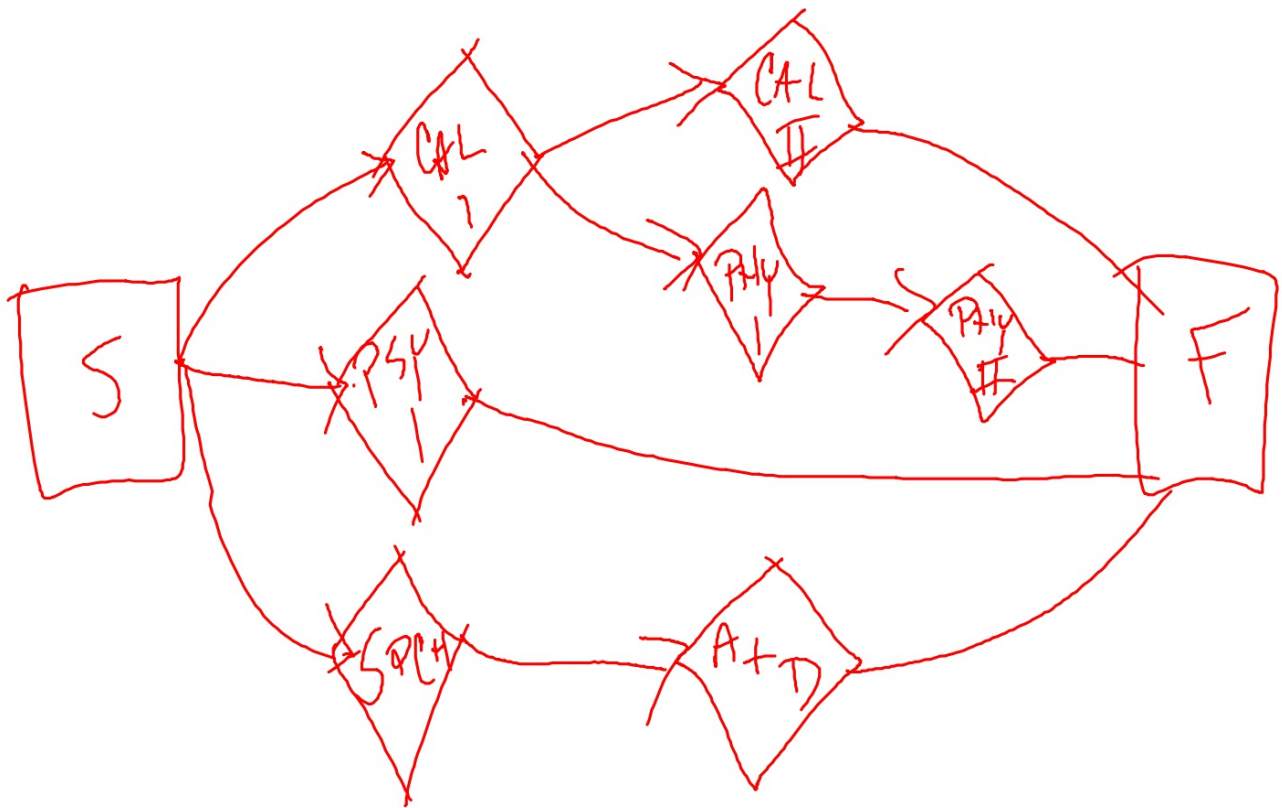VII.D Student Activity Sheet 11: Activity Graphs

You are in charge of organizing the senior class party. The following is your estimate of the time required to perform all the necessary activities:

Activity	Time (in hours)
A. Plan music playlist	0.5
B. Download music	1.0
C. Buy groceries and decorations	2.0
D. Bake cake and prepare food	1.5
E. Set up	2.0

Since there are several classmates helping, some of these tasks can be performed at the same time. For instance, people can begin setting up the decorations while the cake is baking. However, you cannot bake the cake or set up until after the shopping has taken place. And you cannot begin downloading music until you know what songs you want to download. The following *activity graph* can be used to help organize this information:

Handwritten: S-A-B-F 1.5 F
S-C-D-F 3.5 F
S-C-E-F 4

1. What do the numbers in this graph represent? *Handwritten: TIME (HOURS)*

2. Why is there an arrow going from Activity A to Activity B, but not from Activity A to Activity C? *Handwritten: A IS NOT A PREREQUISITE OF C.*

3. Beginning at Start, there are several paths through the graph (following the arrows) that end at Finish. For each path, calculate the total time required to perform all the activities along the path.

Networks and Graphs: Program Evaluation and Review Technique (PERT) Charts
VII.D Student Activity Sheet 11: Activity Graphs

4. What is the *minimum* amount of time required to perform all five activities?

5. Which path corresponds to this *minimum* time? Which activities are along this path?

6. Which activities could take a little longer to complete *without* affecting the total completion time?

[Handwritten: 4; BUY STUFF; START - C - E - FINISH · SET UP; PLAN, MUSIC, DOWNLOADING, BAKING]

Scheduling classes in college can be very similar to the previous scenario. Over four years, there are certain classes that you must take, and many classes have prerequisites—classes that must be taken first. Suppose you need to take the following classes with the identified prerequisites.

Class	Prerequisite
Calculus I	None
Calculus II	Calculus I
Physics I	Calculus I
Physics II	Physics I
Psychology I	None
Speech	None
Argument and Debate	Speech

7. Construct an activity graph for this situation using the following rules:
   - Create Start and Finish squares.
   - Any activity that can be performed right away is connected to Start.
   - Activity A is connected to Activity B by an arrow **only when** Activity A needs to be performed directly before Activity B.
   - Any activity that does not precede any other activity can be connected to Finish.

8. Identify the longest path from Start to Finish. How long is this path?

[Handwritten: S - CI - PH1 - PH2 - F]

9. If each class is a semester long, how many semesters are needed to take all these classes?
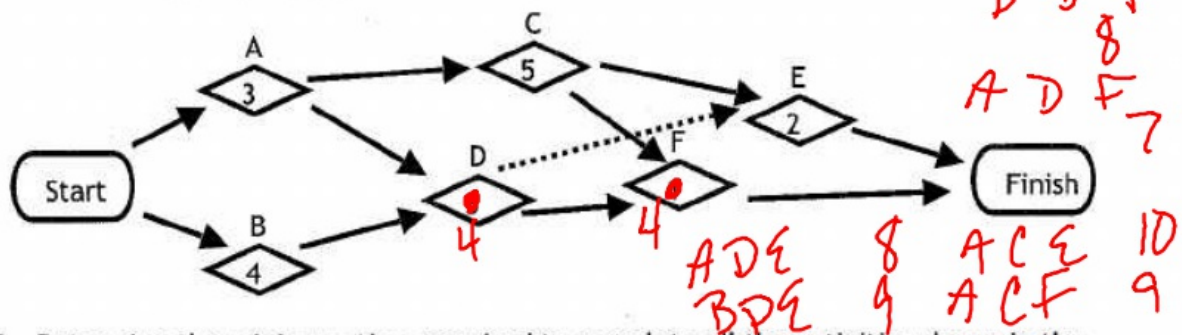
[Handwritten: 3]

Networks and Graphs: Program Evaluation and Review Technique (PERT) Charts
VII.D Student Activity Sheet 11: Activity Graphs

10. If you want to finish these classes as soon as possible, which classes should you not delay taking?

CAL I   PHY I   PHY II

11. How long could you wait to take Psychology I without delaying your overall program of classes?

2 SEMESTERS

12. How long could you wait to take Speech without delaying your overall program of classes?

1 SEMESTER

13. Given any activity graph like the previous ones, explain how you would determine the minimum time required to perform all activities.

LENGTH OF LONGEST PATH

14. Activities that cannot be delayed without increasing the minimum time for completion are called *critical activities*. Given any activity graph like the previous ones, explain how you would determine which activities are critical activities.

ACTIVITIES ON LONGEST PATH.

For the following activity graph, the times given for each activity are in hours.

B D F 8
A D F 7
A D E 8   A C E 10
B D E 9   A C F 9

15. Determine the minimum time required to complete all the activities shown in the graph.

10

16. Which activities are critical activities?

A   C   E

17. How long could Activity F be delayed without affecting the overall completion time?

1 HOUR

18. How long could Activity D be delayed without affecting the overall completion time?

1 HOUR

Networks and Graphs: Program Evaluation and Review Technique (PERT) Charts
VII.D Student Activity Sheet 11: Activity Graphs

19. What if Activities F and D were both delayed? *OKAY = NO HARM*

20. REFLECTION: Can you find a formula that determines how long an individual activity could be delayed without affecting the total completion time for all the activities?

    Sometimes the time to complete an activity is given by two numbers: the estimate for a minimum completion time and the estimate for a maximum completion time. How would having two possible completion times affect your analysis?

21. EXTENSION: Design a chart to represent the planning and design of a particular event at your school, (for example, Project Graduation, prom, fundraiser, community project). Prepare a short presentation including appropriate visuals to share with the class.

LENGTH OF CRITICAL PATH

LONGEST PATH (WITH ACTIVITY)

AMOUNT OF DELAY