SAMUEL ADEGBOYEGA UNIVERSITY

DEPARTMENT OF BUSINESS ADMINISTRATION

BUS 313

(QUANTITATIVE ANALYSIS FOR BUSINESS DECISION)

NETWORK ANALYSIS

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INTRODUCTION

Network analysis or models are used for project evaluation and are applied to a wide range of management problems in private or public sectors.

The network model was developed in 1950 by the Naval Project Office in the United State. The development was with a view to enable management know the following;

I. Time of completion of the project
II. Time the individual part of project is scheduled to start and finish
III. Which part of the project must finish on time to avoid delay (Critical Path)
IV. The possibility of shifting resources to critical path of project from Non critical path
V. Where management should concentrate its efforts at any time among other part of the project

The models include;

1. Project Evaluation Review Technique (PERT)
2. Critical Path Method (CPM)

The models are used to schedule, organise and coordinate tasks within a project and are applied in the following are:

I. Planning for traffic flow to minimize congestion on hold-ups in cities
II. Determine the shortest pick-up and delivery routes for package handling companies
III. Examine project maintenance and layout system.

A PERT chart is a graphic illustration of a project as a network diagram that consist of *nodes* (either circles or rectangles) representing events and milestones in the project linked by labelled *vectors* (directional lines) representing tasks in the project. The direction of the arrows on the lines indicates the sequence of tasks. The tasks between each node must be completed in a sequential way known as *dependent* or *serial* tasks. Some tasks not dependent on the completion of one to start the other and others can be undertaken simultaneously.

STEPS INVLOVE IN Project Evaluated Review Technique (PERT) AND Critical Path Method (CPM)

i. <u>Activities Listing</u>

An activity is a particular piece of work identifiable as an entity within a given project. When a project is identifiable or defined, it is broken down into number of jobs known as activities. Activity is represented by an arrow. Thus, activity

listing involves breaking down the project into series of activities and for each activity, list all the immediate predecessors.

ii. Estimating the expected time for the activities/Project completion

This is the time that a project is expected to be delivered or completed.

Mathematically, expected time (t) = $\frac{a + 4m + b}{6}$

Where, a = Optimistic time

m = probable/most likely time

b = Pessimistic time

iii. Develop the sketch/Drawing of Network:

The sketch or network give an idea on how the partners work, project will be schedule, order at which activity is carryout. The network must start with the **START NODE** and end with the **END NODE**. The node symbolize an event (moment in time when a job or jobs are complete and the next job or jobs start). Events are represented by a circles or rectangle node.

In a PERT diagram, the main building block is the event, with connections to its known predecessor events and successor events.

Predecessor event: an event that immediately precedes some other event without any other events intervening. An event can have multiple predecessor events and can be the predecessor of multiple events.

Successor event: an event that immediately follows some other event without any other intervening events. An event can have multiple successor events and can be the successor of multiple events.

iv. Draw the Path Diagram and compute the key:

A path is the sequence of connected activities that leads one from the beginning of the project to the end of the project. The longest path is known as the critical path and each activity in the path must have zero slack.

For computing the times the Forward Pass and Backward Pass are used at this stage using the following formula;

EF = ES+ D

LS = LF – D

Slack Time = LF – EF or LS – ES

KEY:

ES =Earliest Start Time

EF = Earliest Finish Time

D = Duration or expected Time

LS = Latest Start Time

LF = Latest Finish Time

S = Slack

EXAMPLE ONE:

SAU Water is a proposed sachet and table water firm designed to cover the University and its environment at a price that will give the firm the strongest market position in the industry. The pioneer M.D is concerned that the product gets the right approval from the relevant authorities. He then breakdown the project into the following activities in times estimated in days for proper and effective coordination. The table below shows the activities as listed by the M.D

Activity	Activity Description	Immediate Predecessor	Optimistic Time	Most-likely Time	Pessimistic Time
A	Develop a feasibility study	-	2	3	10
B	Identify and build a structure	A	2	4	12
C	Deploy all equipment to site	A	2	3	4
D	Installation of equipment	C	6	8	22
E	Seek for licence from relevant authorities	B	4	6	8
F	Test run of equipment's	C	3	4	5
G	Correct changes	D, E	1.5	3	4.5
H	Completion of structure	B	5	7	15
I	Purchase of other materials	H	3	4	5
J	Inspection of equipment by relevant authority	G, I	2	4	6

i. Determine the expected time for the activity

ii. Draw the path diagram

iii. Identify the critical path activities

iv. How many days will it take to complete the project?

SOLUTIION

(i). Calculate the expected time for each activity using;

Expected time (t) = $\frac{a + 4m + b}{6}$

t(a) = $\frac{2 + 4\,(3) + 10}{6}$, t (a) = $\frac{24}{6}$, t(a) = 4

t(b) = $\frac{2 + 4\,(4) + 12}{6}$, t (b) = $\frac{30}{6}$, t(a) = 5

t(c) = $\frac{2 + 4\,(3) + 4}{6}$, t (c) = $\frac{18}{6}$, t(a) = 3

t(d) = $\frac{6 + 4\,(8) + 22}{6}$, t (d) = $\frac{160}{6}$, t(a) = 10

t(e) = $\frac{4 + 4\,(6) + 8}{6}$, t (e) = $\frac{36}{6}$, t(a) = 6

t(f) = $\frac{3 + 4\,(4) + 5}{6}$, t (f) = $\frac{24}{6}$, t(a) = 4

t(g) = $\frac{1.5 + 4\,(3) + 4.5}{6}$, t (g) = $\frac{18}{6}$, t(a) = 3

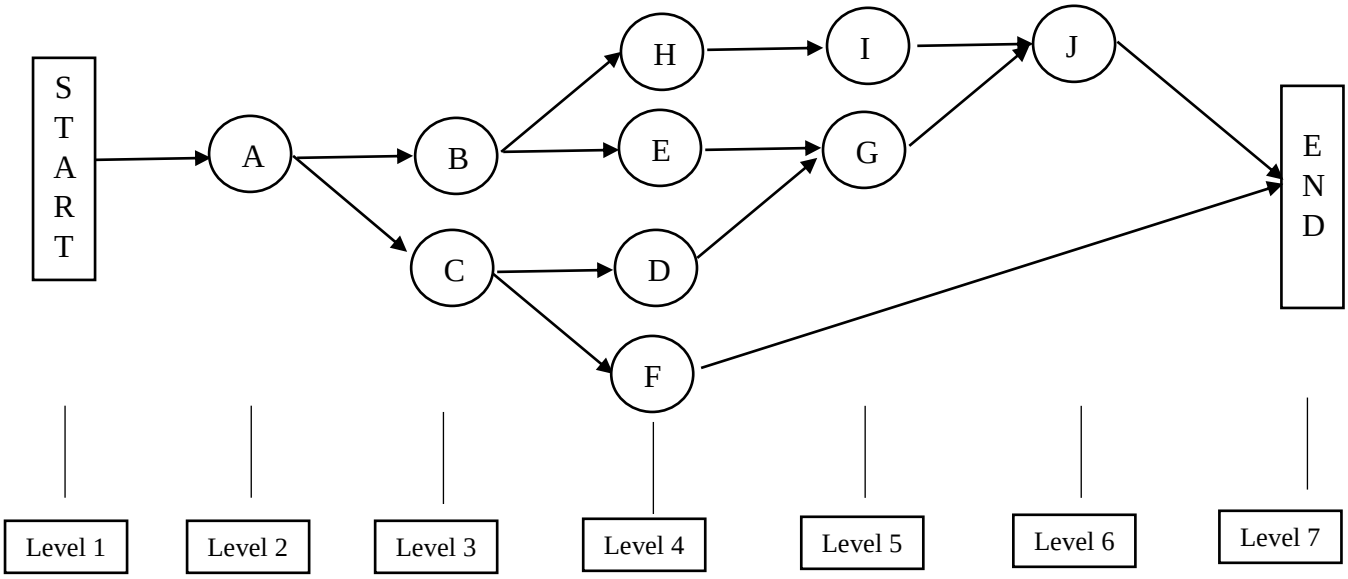
t(h) = $\frac{5 + 4\,(7) + 15}{6}$, t (h) = $\frac{48}{6}$, t(a) = 8

t(i) = $\frac{3 + 4\,(4) + 5}{6}$, t (i) = $\frac{24}{6}$, t(a) = 4

t(j) = $\frac{2 + 4\,(4) + 6}{6}$, t (j) = $\frac{24}{6}$, t(a) = 4

(ii). Draw path diagram.

When developing a sketch, we start with the START NODE and the first activity with no predecessor come first. All arrow must come into the activity from the right hand side and leave the activity from the left hand side.



(iii). Identify the critical path activities

To identify the critical path activities, we will use both the forward pass and the backward pass method.

The key for achieving this include;

KEY:

ES	D	EF
ACTIVITY		
LS	S	LF

ES =Earliest Start Time

EF = Earliest Finish Time

D = Duration or expected Time

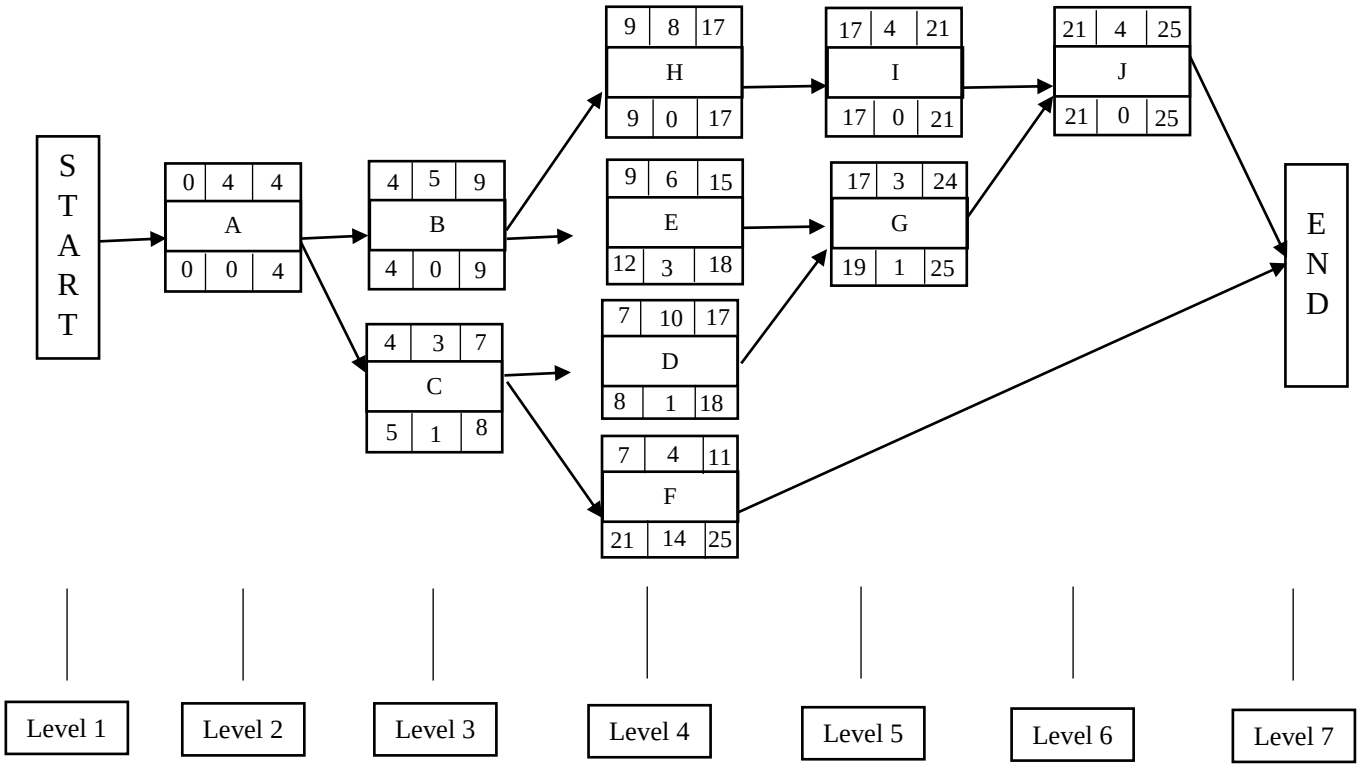
LS = Latest Start Time

LF = Latest Finish Time

S = Slack

Thus; EF = ES + D

LS = LF – D



The critical path activities of the project are:

Activity A, B, H, I and J and it will take 25 day for the project to be completed

Assessment

1. Define the following: (i) Activity (ii) Event (iii) Network
2. Christy Venture has completed the design and testing of Chin-chin production and you are required to the product the best possible promotion in selected market areas within Ogwa, Ebele, and Igueben of Edo State. Use the activities listed below:
   a. **Develop advertising plan**
   b. **Develop promotion and training material plan**
   c. **Develop the training plan**

d. Schedule the radio and other media platform

e. Develop the advanced copy that will be required

f. Contact the training program

g. Prepare production material that will be used during the introduction

h. Screening and select the managers who will train participants

i. Final introduction of the product (Pure and table water)

If activities A, B, and C are preceded by no activity, activity **A** precedes activity **D**, activity **B** must be completed before activity **E** starts, activity **G** must not start until activity **D** is completed, activity **F** precedes activity **H**, and activity **I** can be taken when activity **E,G,H** are completed.

(i) Design the activity list

(ii) Develop the sketch for the list