BASIC CRITICAL PATH METHODOLOGY & NETWORK TECHNIQUES

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Front matter

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CHAPTER 1 SECTION 1

BASIC INTRODUCTION TO CRITICAL PATH METHODOLGY AND NETWORK TECHNIQUES

INTRODUCTION

Companies the world over are continuously faced with the common problem of how to develop, design, manufacture and produce the first batch of a new product with a minimum amount of confusion, in a minimum time span and most important of all within minimum costs. Various monitoring techniques have been evolved for helping management to administer a new project. Graphs, bar charts, line of balance, and many others have been tried but found to have serious shortcomings. Today managements have a new tool for aiding them in project administration.

1. A tool that has proved its worth on large, medium and small projects; that highlights organisation, activities, processes and procedures, costs and budgets, clarifies their inter-relationship and their inter-dependencies. It is suitable for first batch or one-off planning, (i.e. buildings), scheduling and control. This management tool is known as ‘PERT’ Program Evaluation and Review Technique.

2. Other terms to describe the same technique are ‘Network Scheduling’ ‘CPA’, meaning Critical Path Analysis, ‘CPM’, Critical Path Method etc. Since the inception of this technique well over a hundred acronyms have been used to describe it. There is NO BASIC difference between any of these and the labels attached to them and the distinctive features often claimed are largely selling points; similar to the names and well publicised properties of well know washing powders. All computer programmes have been standardised and use the term MICRO PLANNER to describe this management tool and this, is he term used throughout this manual.

3. This manual is an introduction to the basic principles of MICRO PLANNER and Network Techniques. At the conclusion of it you should be capable of drawing fairly sophisticated networks. The facility in operation of networks and the avoidance of pitfalls can only come with experience.

CHAPTER 1 - SECTION 2

BASIC INTRODUCTION TO CRITICAL PATH METHODOLGY AND NETWORK TECHNIQUES

BASIC PRINCIPLES

To illustrate the basic principles of MICRO PLANNER, various examples will be used, in the construction and engineering fields.

1. In most projects whether they be of engineering or construction type consist of four main functions:

   (a) Design

   (b) Procurement of Materials and

   (c) Manufacture or Construction.

   The fourth is Co-ordination.

2. Good planning has always been essential to efficiency, but just as important as planning is the quality of the relationship between different members of the project team. It must be remembered that MICRO PLANNER is a team effort and success or failure rests on the amount of team effort applied.

3. Success, viewed from any standpoint, depends first on a good network and second and equally important, a means of conveying the meaning of the network to those who must execute it and of coordinating their efforts.

4. MICRO PLANNER not only forms the basic plan in a logical form, but has a coordinating function. It indicates to management where the trouble areas lie and points out to those in the project team their own particular responsibilities and their relationship to other members of the team. Just how this is done can be best shown by going into some detail of the technique.

CHAPTER 1 - SECTION 3

BASIC INTRODUCTION TO CRITICAL PATH METHODOLGY AND NETWORK TECHNIQUES

ELEMENTS OF A NETWORK

What does a MICRO PLANNER network look like? It is a street plan more than anything else. A street plan or road map is a network of the inter-connecting links of travel. Just as the detail on a street plan varies so does the detail on a MICRO PLANNER network. What is a network? It is the pictorial representation of the Plan which shows the inter-relationships and inter-dependencies of the component tasks, (Figure 3.1), it is sometimes known as a 'logic diagram' or 'arrow diagram'. However the term 'network' is more commonly used throughout this manual.

1. Network Techniques

The importance of accurate network construction cannot be over-emphasised, for it is the foundation upon which the whole structure of the network depends. A network must logically express the sequence and pattern of work flow as well as the relationships and restraints implicit in the intended plan of operations. Before commencing to construct the network, it is preferable if a written brief or specification is prepared for the project, clearly defining all the objectives to be accomplished. Since networks can be drawn for different levels of management, i.e. with greater or lesser detail, it is important to establish the nature and amount of detail to be included for the level of indenture concerned. Accurate network construction can often be achieved more readily as a team effort be key personnel having specific knowledge of the activities and processes involved. The leader of the team should be fully conversant with the rules and conventions applicable to network logic.

2. Network Diagrams

A MICRO PLANNER network can be represented by one of two techniques, arrow diagrams or precedence diagrams. The basic element of each is the activity, which represents a task to be performed. Each activity is given a duration, which defines the time required to complete the task.
Networks can be subdivided into smaller units called sub-networks. Each sub-network must be logically complete. Sub-networks are the smallest unit that can be processed by MICRO PLANNER X-PERT but they can be linked together to form larger networks.

3. Arrow Diagrams

The two elements of an arrow diagram are directional lines (or arrows) each representing one activity, and circles representing events. Events represent the points at which activities start and finish.

In Figure 3.1 BUILD SECTION 1 and MAKE UP COMPONENT 2 finish at event E4, is a name given to an event and is known as the identifier by their preceding event and succeeding event identifiers. Therefore, in Figure 3.1 the first activity is identified as E1-E2, its description is PREPARE SITE and it has a duration of four (4) time periods. Events may also be given descriptive data. For example, event E1 can be described as START OF NET1. However, as previously stated an event cannot have a duration.

An event is achieved when its preceding activities are completed. For example, in Figure 3.1 event E4 (COMPONENT 2) and E2-E4 (BUILD SECTION 1) are complete.

Accurate representation of the project by the network is very important, since the data that defines the network is the basis on which analysis is performed. The activities must be placed in logical work sequence, showing which may be worked at the same time. In Figure 3.1 MANUFACTURE PART A, BUILD SECTION 1 AND BUILD SECTION 2 can be worked at the same time, but cannot start until PREPARE SITE has finished.

Activities may have properties that affect the way in which the network is processed. Such activities are described using the following activity types:

DUMMY ACTIVITY This is an activity that represents not an actual task but a logical link between network paths.

LADDER ACTIVITY Ladder activities are a special group of activities that are used to represent progressive feed tasks; for example, in the manufacture of parts that are used to assemble components that are in turn used to make up finished products.

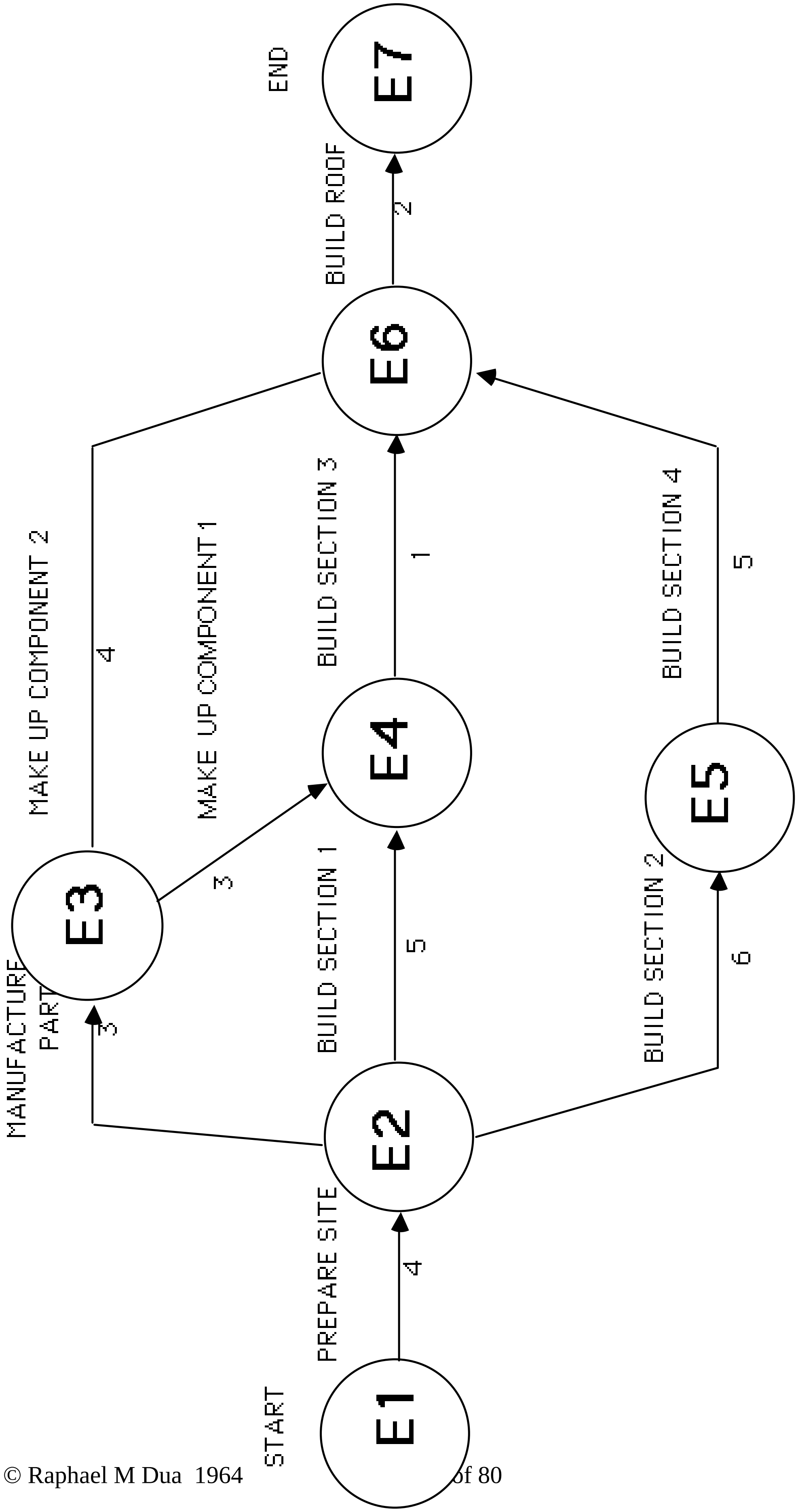


FIGURE 1 – EXAMPLE ARROW NETWORK OF NET 1

HAMMOCK ACTIVITY If summaries are required or information is needed about a particular phase of a network, a hammock activity can be defined. It can be used to span a number of activities within a network. Its duration is calculated by the MICRO PLANNER program.

Similarly, events may have properties that effect the way in which the network is processed. Such events are described using the following event types:

START EVENT This represents the logical start of a network path.

END EVENT This represents the logical end of a network path.

INTERFACE EVENT Networks can be subdivided into smaller processing units called sub-networks. Interface events denote points in time at which activities in different sub-networks are dependent on each other.

Each of these activity and event types is described in greater detail in a later section of this manual.

4 Precedence Diagrams

Precedence Diagrams use boxes to represent the basic network elements, the activity. The other element of precedence networks is the dependency, which defines the logical link between activities. A dependency is shown in a precedence network diagram as a line.

In Figure 3.2, the dependencies show that BUILD SECTION 4 is logically after BUILD SECTION 2, and that MANUFACTURE PART A, BUILD SECTION 1 AND BUILD SECTION 2, can all be worked at the same time but cannot start until PREPARE SITE is complete.

In precedence networks, activities are identified by an activity identifier; for example, A1, A2, A3 etc, in Figure 3.2. Activities have durations giving the period of time required to perform the task, and may have descriptive data attached to them.

Dependencies in precedence networks are more flexible than events in arrow networks. These are four dependency types, as shown in Figure 3.3.

- Finish to start
- Finish to finish
- Start to start
- Start to finish

In addition, dependencies may have durations. For example, a finish to start dependency with a duration of four time periods between activities A1 and A2 implies that A2 cannot start until four time periods have elapsed since the completion of A1.

Dependencies are identified by their preceding activity sub-network and activity identifier and their succeeding activity sub-network and activity identifier. Dependencies are therefore uniquely identified not only within sub-networks but within the whole network. This unique identification means that no special action is required to specify the interfaces in networks with interdependent sub-networks.

As with the arrow diagrams, accurate representation of the project by the network is important.
Dependencies must be set up to ensure that activities are placed in correct logical sequence.

Activities in precedence networks may have properties that affect the way in which the network is processed. The following activity types may be specified in a precedence network.

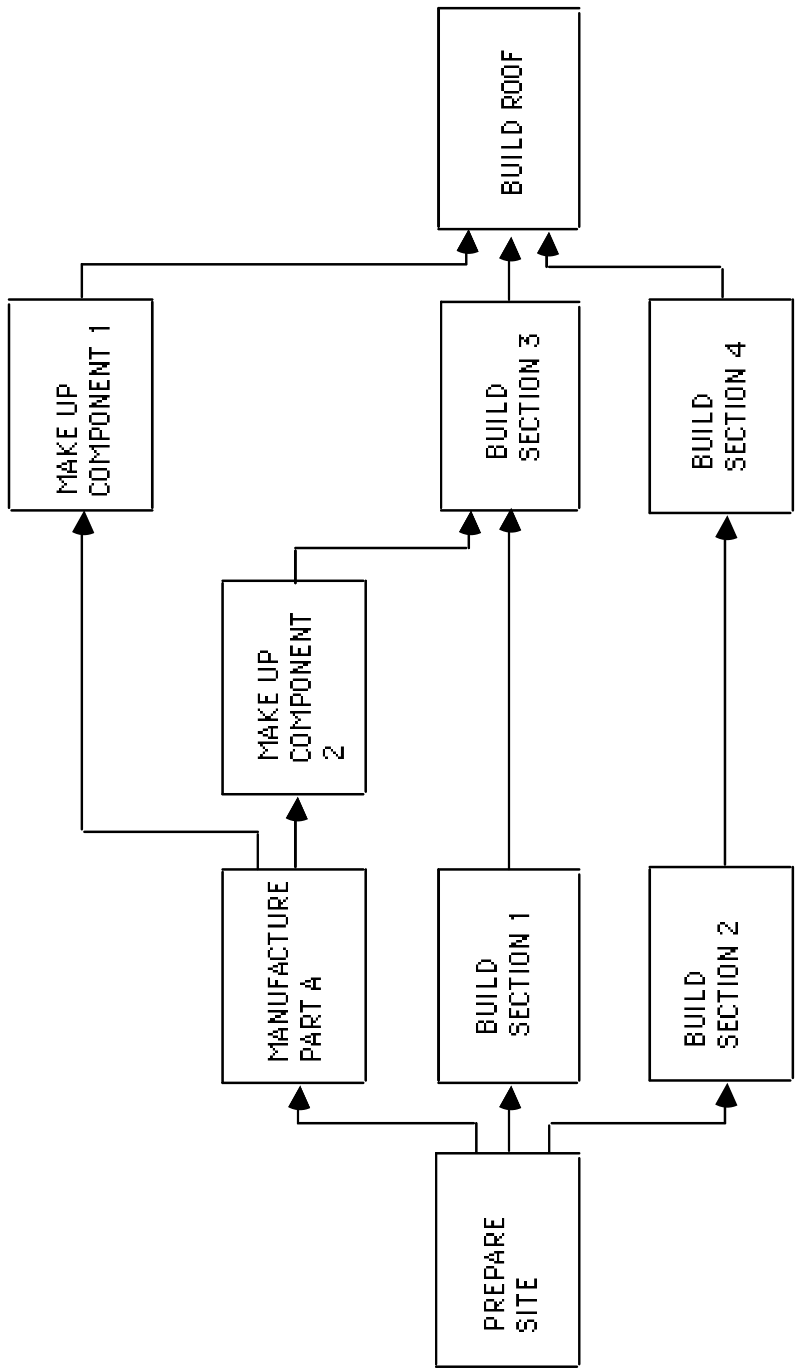


FIGURE 2 - EXAMPLE PRECEDENCE DIAGRAM OF NETWORK 1

DUMMY ACTIVITY This is an activity that represents not an actual task but a logical link between network paths.

HAMMOCK ACTIVITY This is an activity that can be used to span a number of activities within a network. Its duration is calculated by the MICRO PLANNER program.

START ACTIVITY This represents the logical start of a network path.

END ACTIVITY This represents the logical end of a network path.

5. Activity and Event Types

As described in the previous section, activities and events can be given properties that indicate the logic of the network and the way in which it is processed. These properties, more usually called types, are applied according to whether the network is represented by an arrow or a precedence diagram.

Common to arrow and precedence networks are:

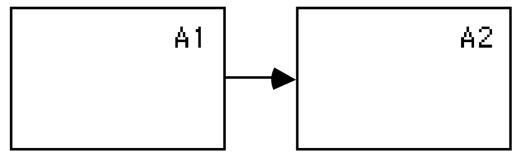
Dummy activities
Hammock activities

For arrow networks only:

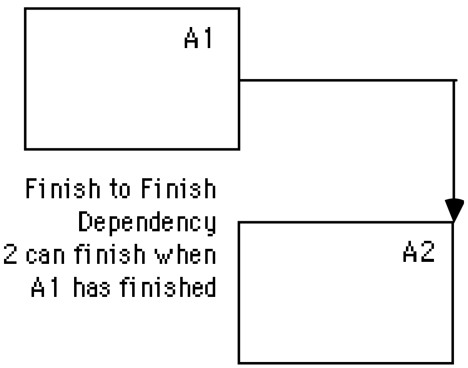
Ladder activities
All event types

For precedence networks only:

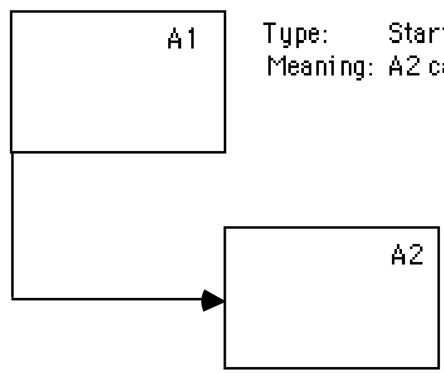
Start activities
End activities



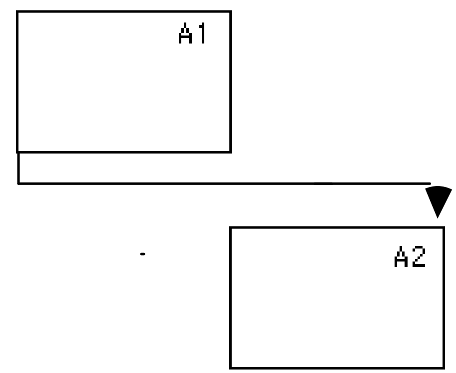
Type: Finish to Start dependency (As used in Figure 2.2)
Meaning: A2 can start when A1 has finished



Type: Finish to Finish Dependency
Meaning: A2 can finish when A1 has finished



Type: Start to Start dependency
Meaning: A2 can start when A1 has started



Type: Start to Finish Dependency means A2 can finish when A1 has started

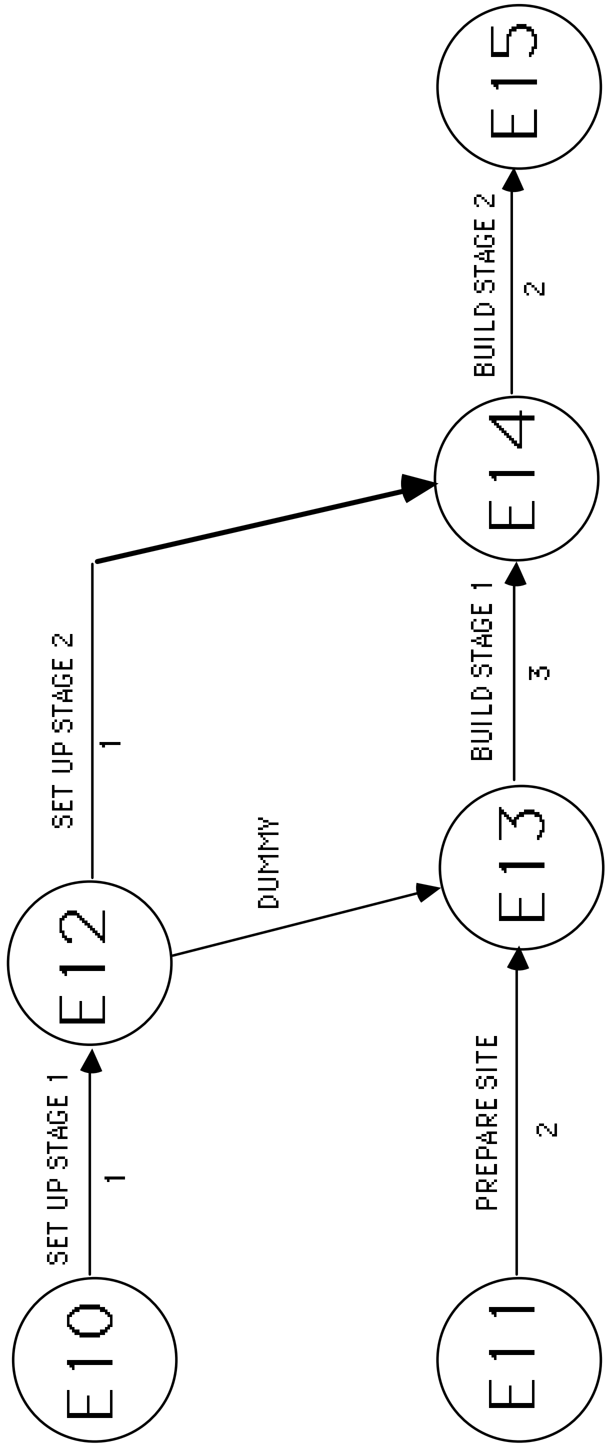


FIGURE 4 – DUMMY ACTIVITY

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6. Dummy Activities

A dummy activity is one that represents a logical link between network paths rather than an actual task to be performed.
In arrow network diagrams, dummy activities are normally indicated by a broken line, as shown in Figure 3.2. In this example, the SET UP ... activities and the BUILD ... activities can be worked in parallel. The network shows the normal constraints for BUILD STAGE 2; i.e. BUILD STAGE 1 and SET UP STAGE 2 must be complete before it can start. The BUILD STAGE 1 activity has a similar dependency shown by the dummy connecting E12 and E13. The network therefore shows that BUILD STAGE 1 cannot be started until SET UP STAGE 1 and PREPARE SITE are complete.

In precedence network diagrams, the box of a dummy activity is drawn with a broken line. Dummies can by used in precedence networks to reduce the number of dependencies that must be defined when a number of successor activities are each dependent on a number of predecessors. For example, in the networks shown in Figures 3.5 and 3.6, activities 4, 5 and 6 cannot start until activities 1, 2 and 3 have been completed. Figure 3.5 shows this section of network using dependencies only; Figure 3.6 shows the same network logic using a dummy activity.

A dummy activity can also be used to provide a common start or end point in a precedence network that has several start or end activities.

Dummy activities normally have a zero duration because they are being used simply to indicate a logical link. However, some dummy activities do not conform to this pattern. For example, in a building project a wait may be necessary while concrete cures. No actual work is being done and the use of a dummy activity may make the network logically correct. However, the time taken for the concrete to cure is obviously important and a duration should be given to this activity. Such activities are called real time dummies.

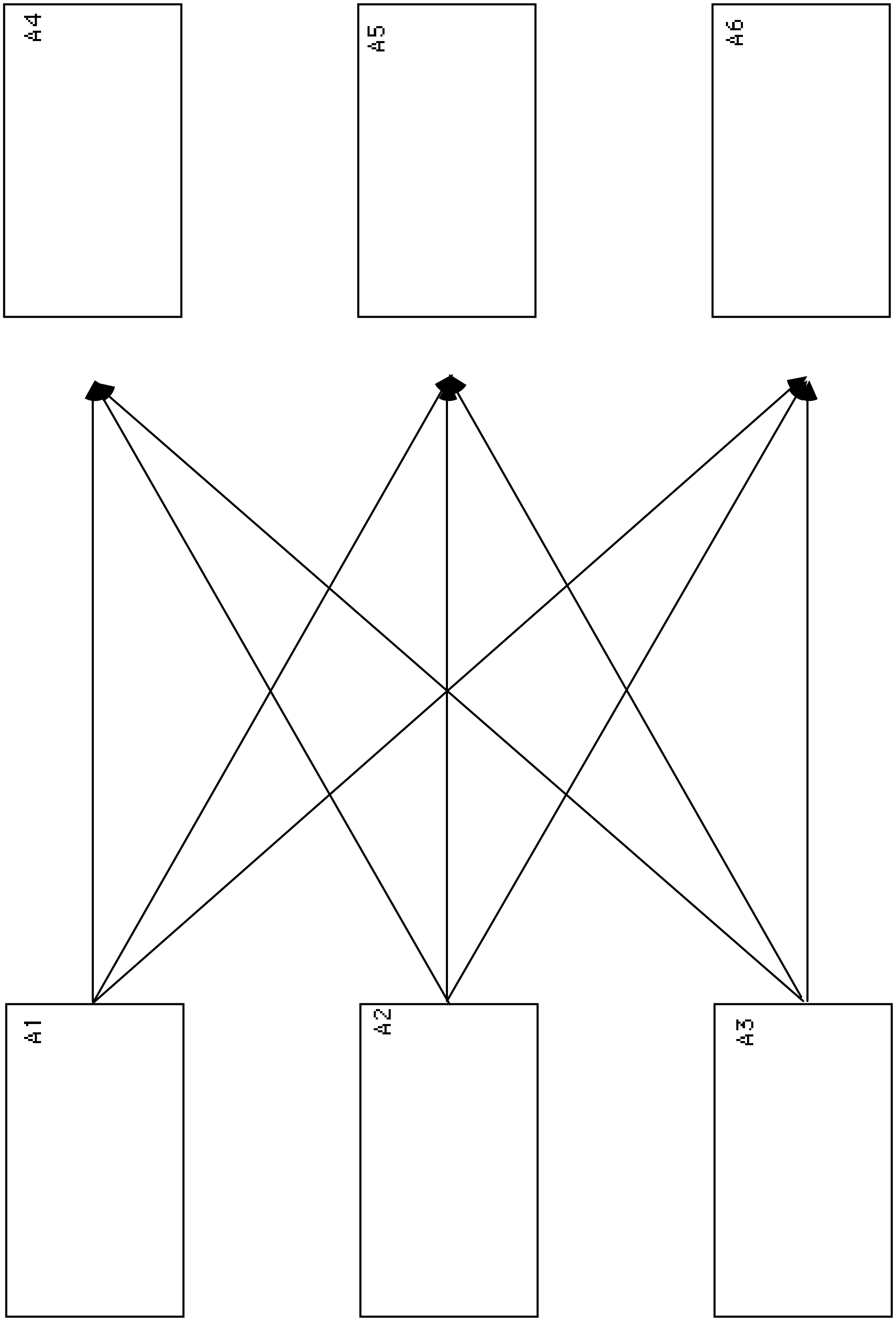


FIGURE 5 – NETWORK SECTION USING DEPENDENCIES

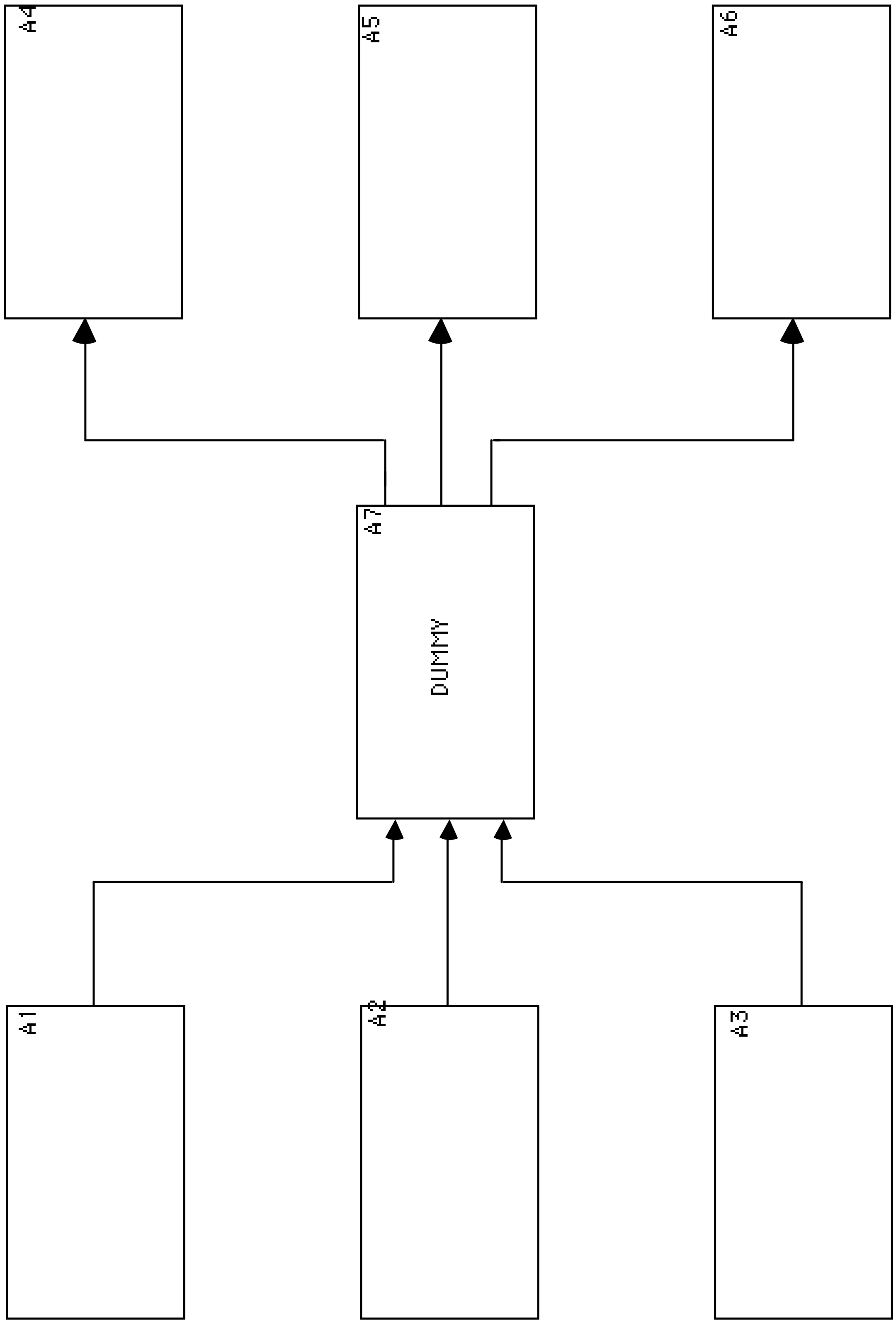


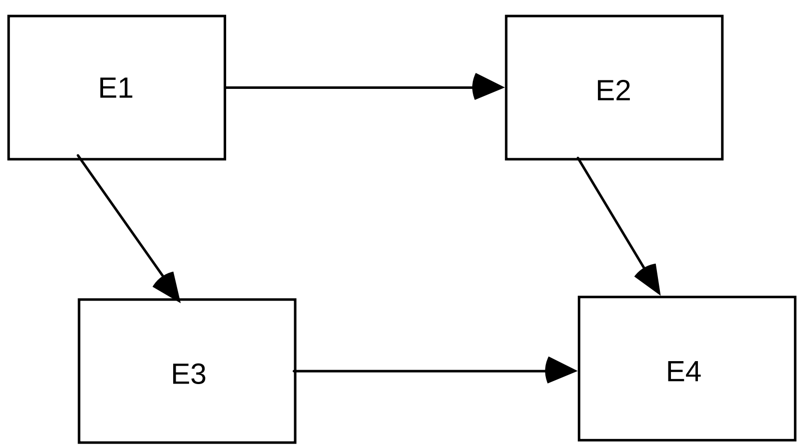
FIGURE 6 - NETWORK SECTION USING A DUMMY

Ladder

Ladder activities are a special group of activities that are used to represent progressive feed tasks. They are relevant only to arrow networks; in precedence networks similar results may be obtained by the normal use of dependencies.

An example of a progressive feed task occurs in the manufacture of a number of identical components, each component having to go through several manufacturing processes. To represent these processes on the network in the normal way would require one activity for the manufacture of the components, another to assemble the unit, probably another for inspection, etc. The same sequence of activities would have to be repeated for each unit required. The resulting network could be extremely complex as shown in Figure 3.7.

Before the second task in such a progressive feed process can start, the first task must have been in progress for a given time to ensure a supply of components for the second task. The time that must elapse before the second task starts is called lead time. similarly, there is a lag time after the completion of the first time before the second task can be completed. This situation is represented diagrammatically as follows:



Activity E1-E2 represents the first task and E3-E4 the second. In the diagram, they are drawn horizontally and are known as the rungs of the ladder. Therefore the rung activities represent the progressive feed tasks.

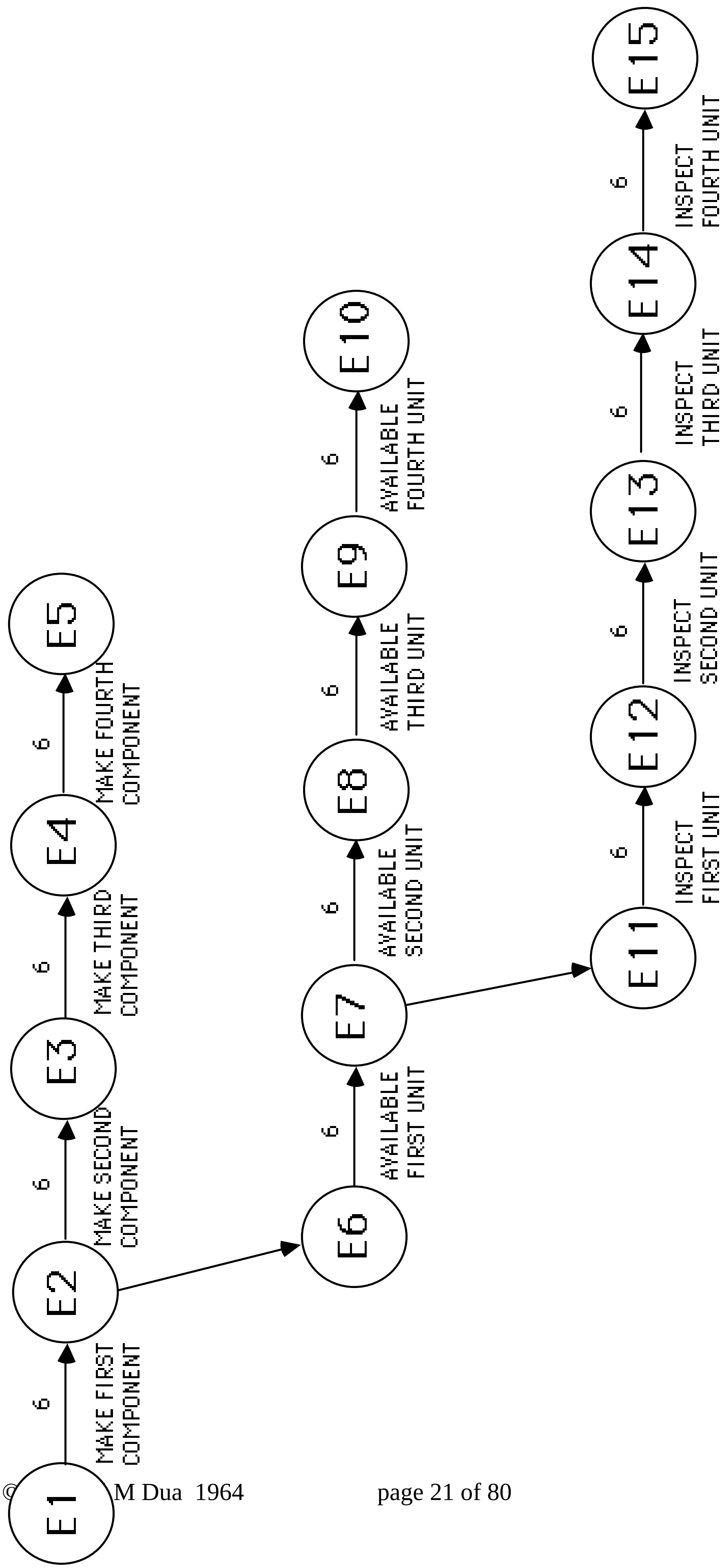


FIGURE 7 – PROGRESSIVE FEED WITHOUT LADDERS

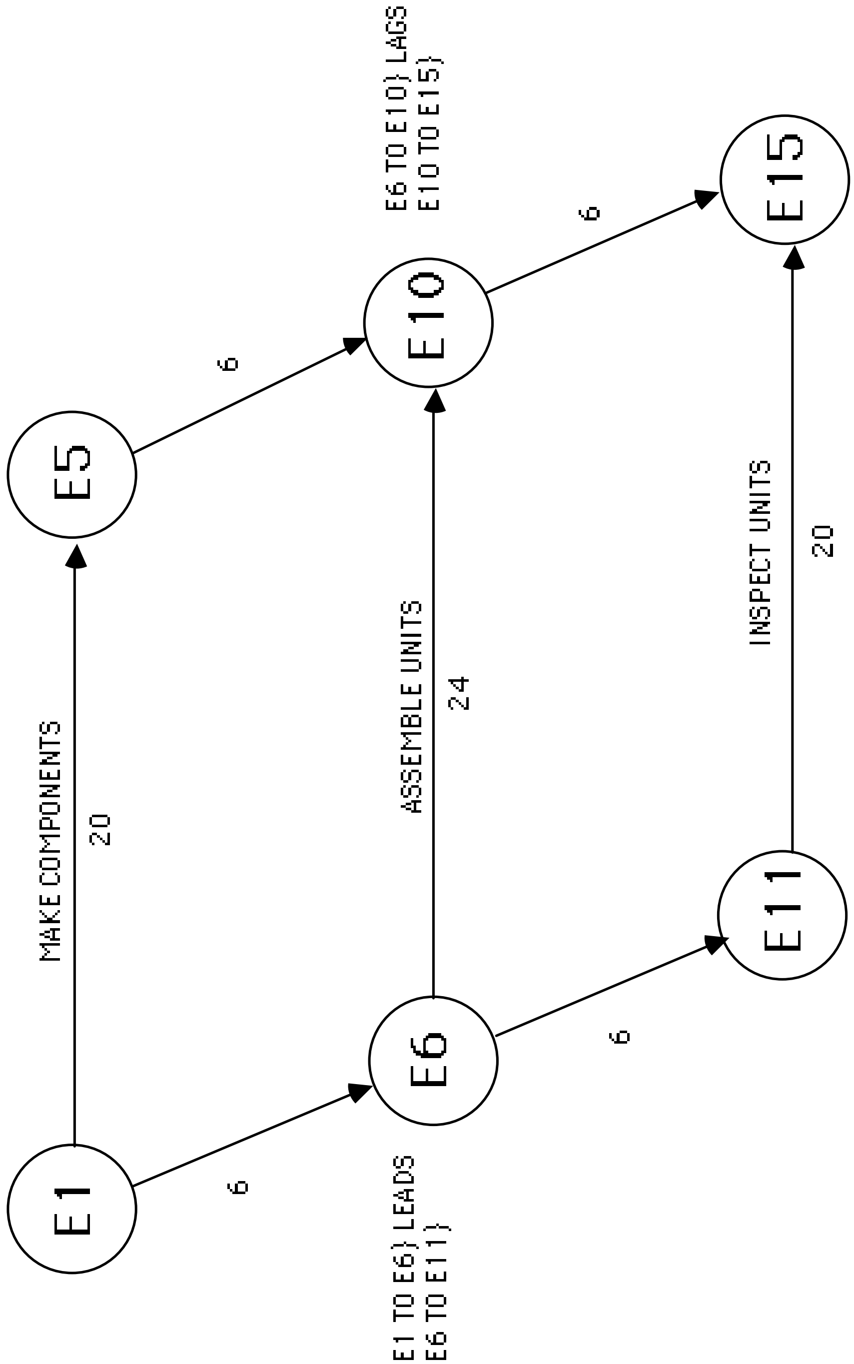


FIGURE 8 – PROGRESSIVE FEED WITH LADDERS

Activity E1-E3 is a led activity, and its duration is equal to the lead time that must elapse between the start time of the preceding and succeeding rungs. The duration of the lead determines the amount of the preceding rung that must have been worked before the succeeding rung can be started.

Activity E2-E4 is a lag activity, and its duration is equal to the lag time that must elapse between rungs. The duration of the lag determines the concluding amount of the succeeding rung that cannot be worked until the preceding rung has been completed.

Figure 3.8 uses a ladder to represent the same progressive feed chain as Figure 3.7, but in a much simpler form. The ladder represents the following logic:

MAKE COMPONENTS, ASSEMBLE UNITS and INSPECT UNITS can all be worked in parallel, but ASSEMBLE UNITS cannot start until five time periods have been worked on MAKE COMPONENTS and cannot finish until six time periods after MAKE COMPONENTS has finished. INSPECT UNITS cannot start until six time periods have been work on ASSEMBLE UNITS and cannot finish until five time periods after ASSEMBLE UNITS has finished.

Rung activities are normal activities given the rung activity type. However, leads and lags are special activities not directly created by the user. The only data supplied by the user about a lead or a lag is its duration, and this is specified with reference to the run activity from which the lead or lag originates.

Therefore in the simple example given above, the durations for lead E1-E3 and lag E2-E4 would be associated with the run activity E1-E2.

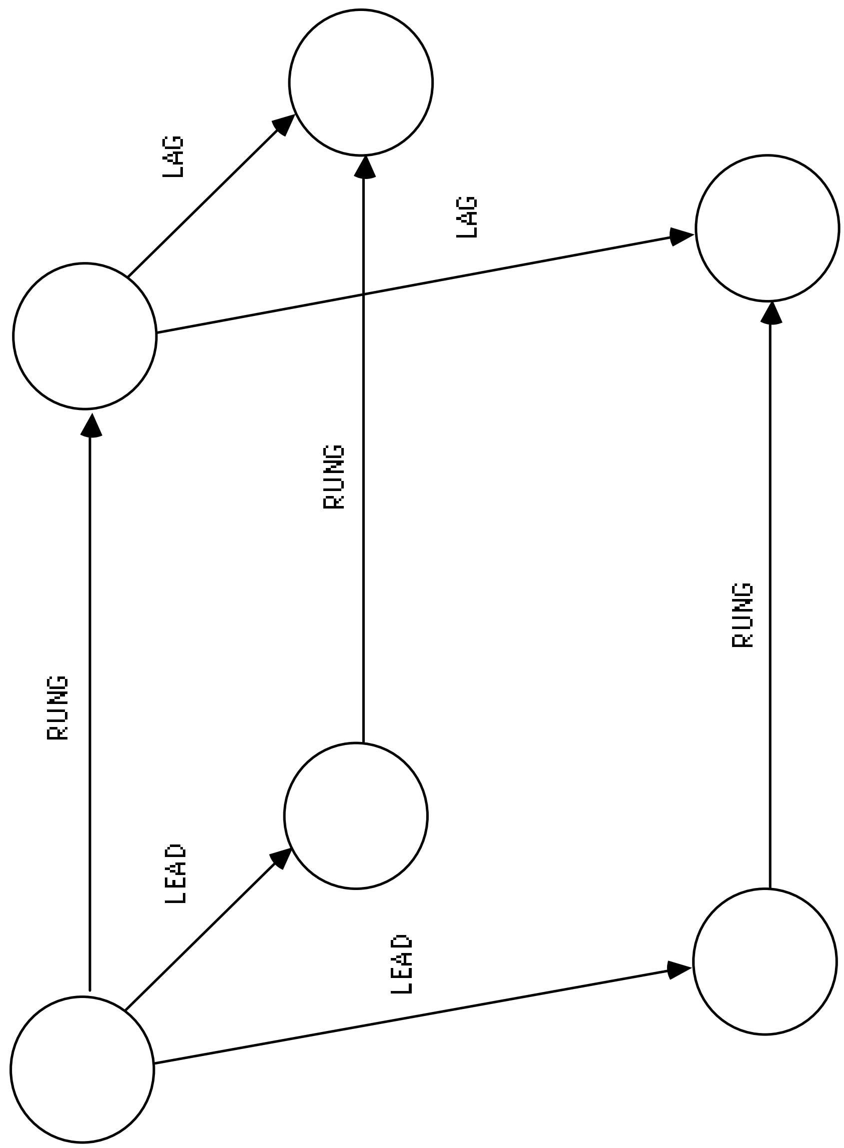


FIGURE 10 – A RUNG OWNING MORE THAN ONE LEAD-LAG PAIR

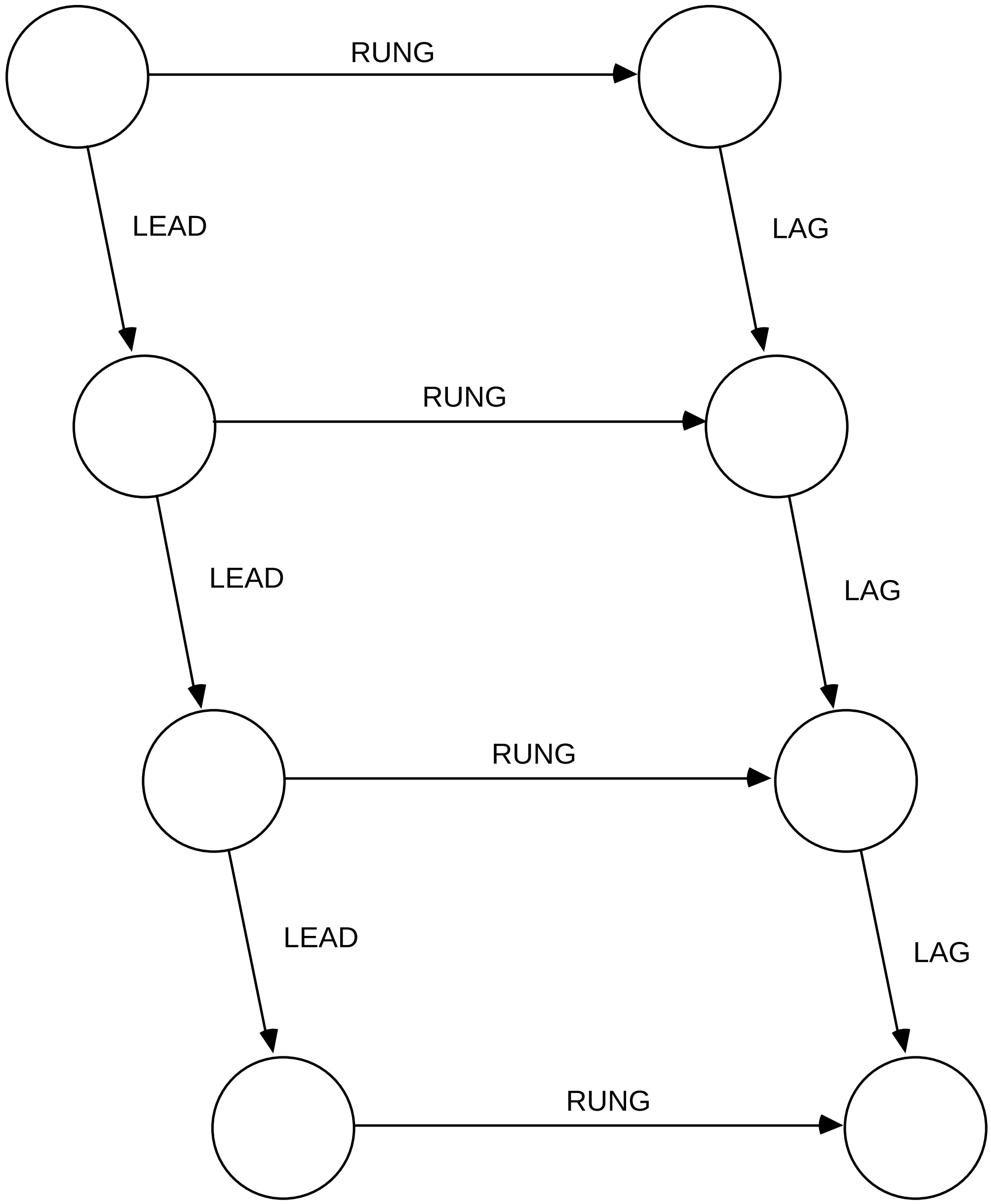


FIGURE 9 - A FOUR RUNG LADDER

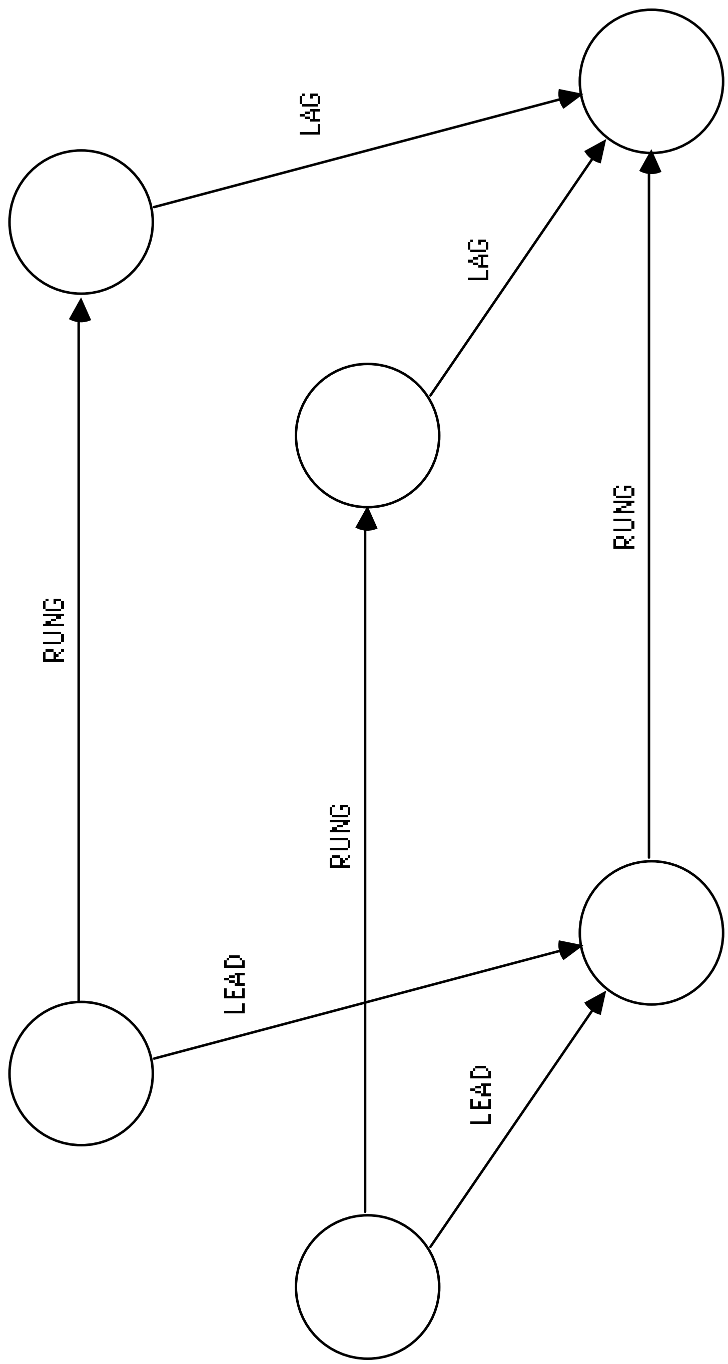


FIGURE 11 - A RUNG WITH MORE THAN ONE PRECEDING RUNG

Complex ladder structures can be created. A ladder can extend to many levels of rungs and branches may occur in the structure. Therefore a rung may own several pairs of leads and lags, and may be the successor to many pairs of leads and lags. Simple examples of such structures are illustrated in Figures 3.9, 3.10 and 3.11.

Note: The ladder technique was invented by ICL in 1964, and has gained wide acceptance in network techniques.

Hammock

A hammock activity can be used to span a number of activities within a network. The duration of a hammock is not specified by the user; it is calculated by Time Analysis.

Hammock activities can be used in various ways, the two most usual applications being as follows:

PRODUCING SUMMARY REPORTS If a project has for example, 12 major phases, each phase consisting of between 100 and 200 activities on the network, hammocks can be used to produce a high level report.

A hammock activity could span each phase of the network and a report selecting hammocks only would give the start and end time and duration of each phase.

SHOWING OVERHEADS Consider, the example, a project that requires specialist equipment to be hired for part of its duration. If a hammock activity is specified from the preceding event of the first activity that requires the equipment to the succeeding event of the last activity that requires it, the duration of the hammock will give the duration of hire.

In an arrow network, the preceding event of a hammock must have a non-hammock activity emanating from it. The succeeding event of a hammock must have a non-hammock activity entering it. See Figure 3.12.

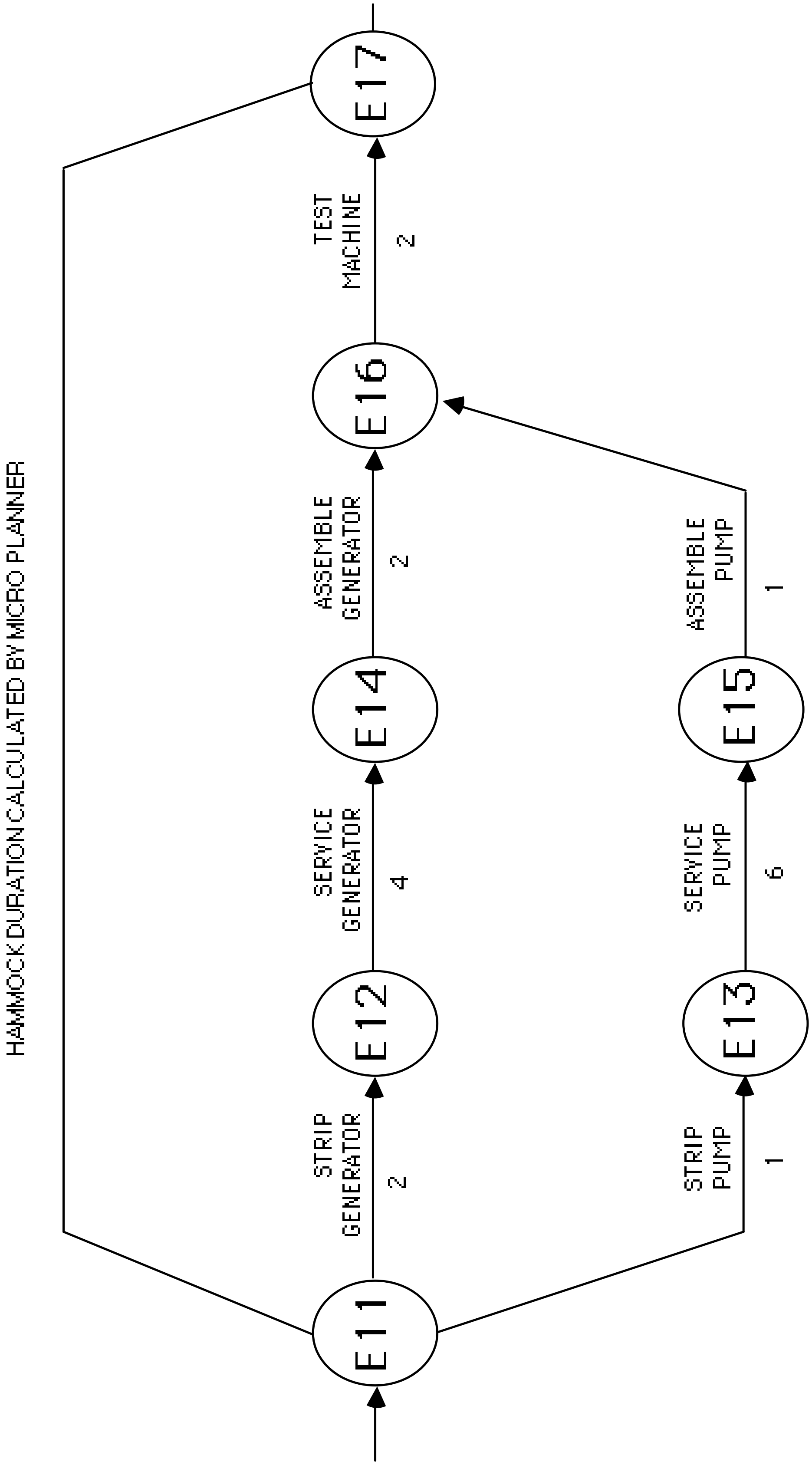
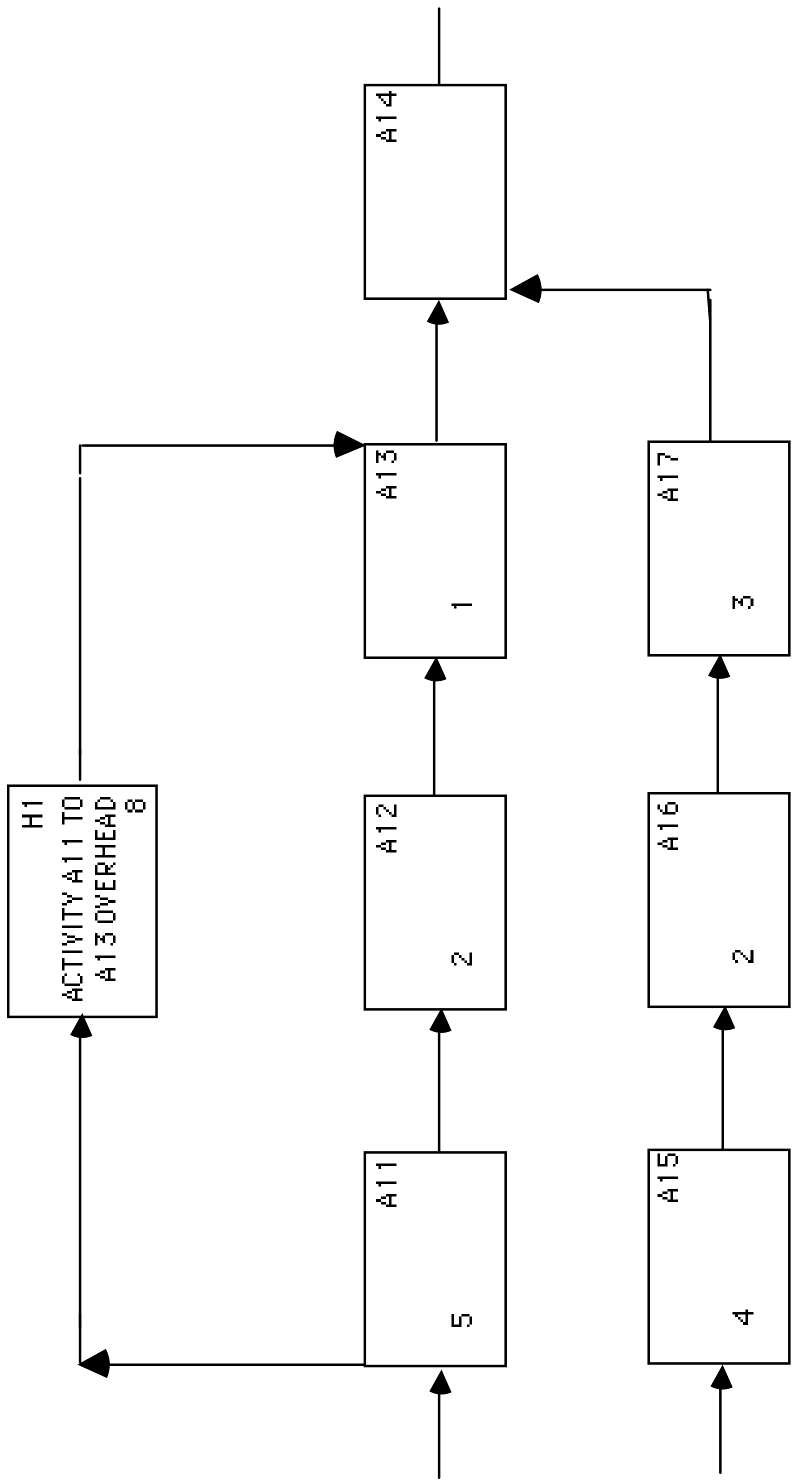


FIGURE 12 - EXAMPLE SECTION FROM ARROW NETWORK SHOWING A HAMMOCK



NOTE: DURATION OF HAMMOCK IS CALCULATED BY MICRO PLANNER

FIGURE 13 – EXAMPLE SECTION FROM PRECEDENCE NETWORK SHOWING HAMMOCK

Starts, Ends and Dangles

Events in arrow networks and activities in precedence networks can be given the type start or end. A start event has no preceding activities and a start activity has no incoming dependencies, and an end event has no succeeding activities and an end activity has no outgoing dependencies. Networks can have several start and end events or activities.

A dangle is a start or end event or activity that has not been specified as such by the user. Although networks with dangles can be processed, the user should check that all start and end dangles detected were intended to be start or end detected were intended to be start or end events/activities. Time Analysis will assume that dangles are logical starts or ends for its calculations and if this is not the case the resulting schedule will be meaningless.

Loops

Occasionally when a network is being constructed an activity is inadvertently inserted such that is causes a section of the network to form a closed loop. This is an illogical condition. Figure 3.14 illustrates, in effect, that Activity 'A' must be completed before Activity 'B' can start; Activity 'B' must be completed before Activity 'C' can start; and Activity 'A' cannot start until the completion of Activity 'C'. When such a condition is found during the analysis of a network, processing must stop; since valid results cannot be produced.

The MICRO PLANNER program, however, prevents loops from being created because network logic always moves from left to right

'

CHAPTER 2 - SECTION 1

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

CONSTRUCTION OF A NETWORK

Before a MICRO PLANNER network can be constructed the MICRO PLANNER team who are familiar with the objectives and requirements of the project concerned must determine the significant activities and events. Each activity selected should be complete task, each event a discernible beginning or completion of a stage of the network. Most important of all the sequence of those activities must be determined. Unfortunately human nature being what it is, each member of the team when asked will give their idea of the sequence of the activities in the network. This stems from the fact that each member believed his department to be the most important and consequently his view is biased. As a result delays will occur in preparing the network or worse still errors will creep in and the project will actually be performed in a different sequence from that on the network.

1. Therefore to obviate this problem there must be general agreement amongst the members of the MICRO PLANNER team as to the actual sequence in which the project will take place. A method to achieve this is the use of a 'Horizontal Time Line' (H.T.L.)

2. Horizontal Time Line

   A horizontal time line is a straight line expressing time, but not to scale. Its length is of no significance nor the number of division along its length. Essentially, a horizontal time line of a Company's operations is merely an expression in general terms of the sequence of activities that must be accomplished in bringing ideas through the research and development stage to the completed product. Preparation of an H.T.L. is the first step in getting agreement in terminology and sequence which must be defined before the activities on the MICRO PLANNER network can be made final.

   For example, the X.Y.Z. Company is a large engineering company, the time span of a project which is to be networked is from 'Project Go-ahead' to '1st Batch Delivered'. The sequence of activities to accomplish this is shown in Figure 4.1 'Horizontal Time Line' of the major activities.

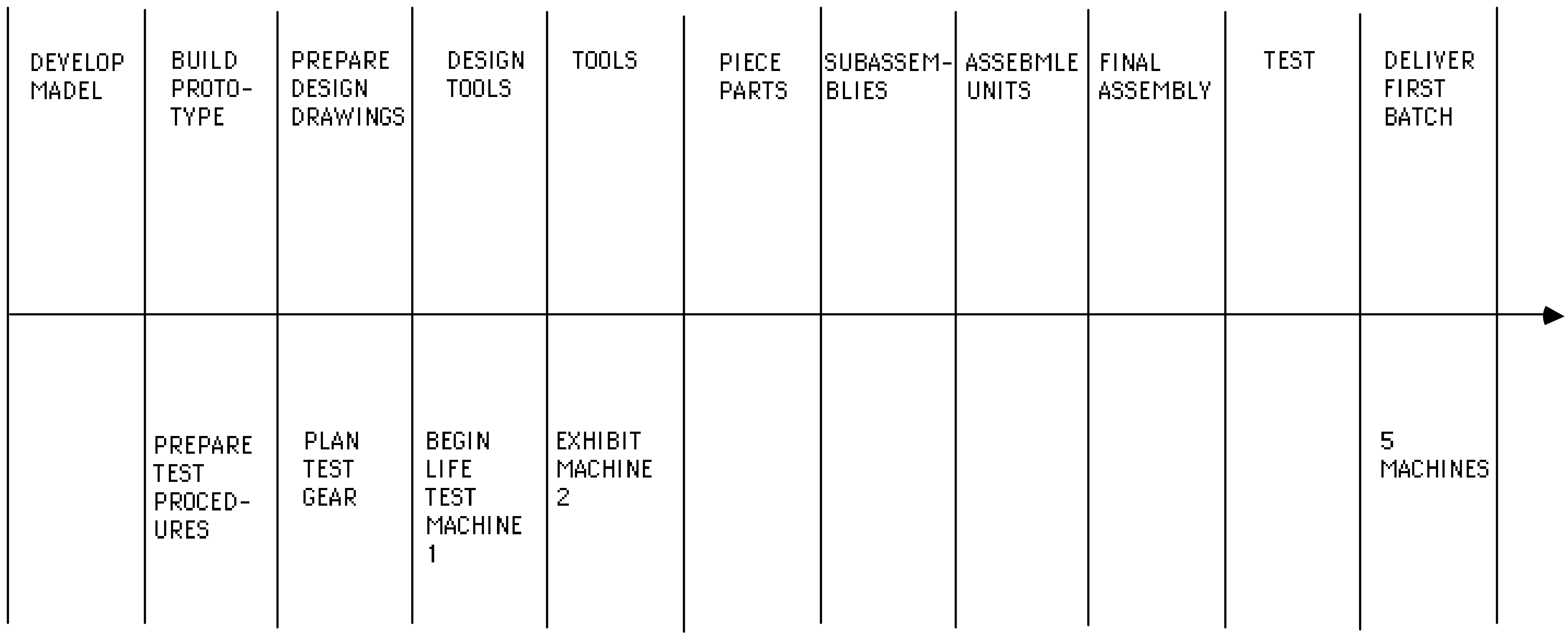


FIGURE 1 – HORIZONTAL TIME LINE – X.Y.Z. COMPANY

It can be seen that on the left of the H.T.L. in generic terms, the construction of a model is the first major activity following management acceptance of the 'scheme' formulated by market Research. Then with management approval, a prototype is built and tested; design development is allowed to proceed when authorised; materials are purchased and subcontracts are let: tools are designed and manufactured; and so on, to the completion of the first batch.

This first breakdown of the project and its constituent parts can easily be broken down further if necessary to give a more detailed description of sequence. For instance the major activity 1 'Build Prototype' can be broken down into more detail, see Figure 4.2.

INITIAL DESIGN	ISSUE DRAW'GS	MAKE TOOLS	MANUF PARTS	ASSEMBLE PARTS	TEST MACHINE

FIGURE 2 - ENLARGED H.T.L. FOR ACTIVITY 'BUILD PROTOTYPE'

This secondary breakdown can be performed for each of the major activities, giving a list of activities to construct the network. It may be necessary to breakdown even further particular activities on the secondary breakdown in order to show a clearer picture of what must happen if the project is to be successful. For instance, the activity 'Manufacture Parts' can be broken down even further, see Figure 4.3.

MANUFACTURE SUB-PART A B	MANUFACTURE SUB-PART C	MANUFACTURE SUB-PART D	MANUFACTURE PART

FIGURE 3 - FURTHER BREAKDOWN OF ACTIVITY 'MANUFACTURE PARTS'

This process of breakdown can be repeated as often as is necessary. When the final breakdown has been achieved, it is obvious that a complete activity list has been created. It is then a simple matter to construct the necessary network. Various levels of networks can be created from the carious breakdown created on the Horizontal Time Line.

3 As an example, assume that a network of the construction of a house is to be drawn. The list of activities and events has already been determined by the MICRO PLANNER team, these are shown in Figure 4.

EVENT	ACTIVITIES
Start	Lay F/dation & Erect Frm
House Roughed in	Lay Bricks
Brickwork completed	Install Lathing
Lathing completed	Install Fixtures
Plastering completed	Plaster House
House ready for painting	Trim Out House
House ready for occupancy	Rough Grdg and Backfill
	Paint House

FIGURE 4 - ACTIVITY / EVENT LIST

A good rule to observe in construction a network is to start at the terminal event. It is far easier to determine what activities have to be completed in order to perform the given activity; than what activities can commence once the given activity has been completed.

Bearing this in mind, the logical terminal event for this example would be 'House ready for occupancy'.
Having fixed the terminal event, the preceding activities and events can be considered. Before the house can be occupied, it must be painted and graded. These jobs would immediately precede the terminal event. Painting and grading are independent of each other, and, therefore can be performed at the same time. This section of the network is illustrated by Figure 4.4.

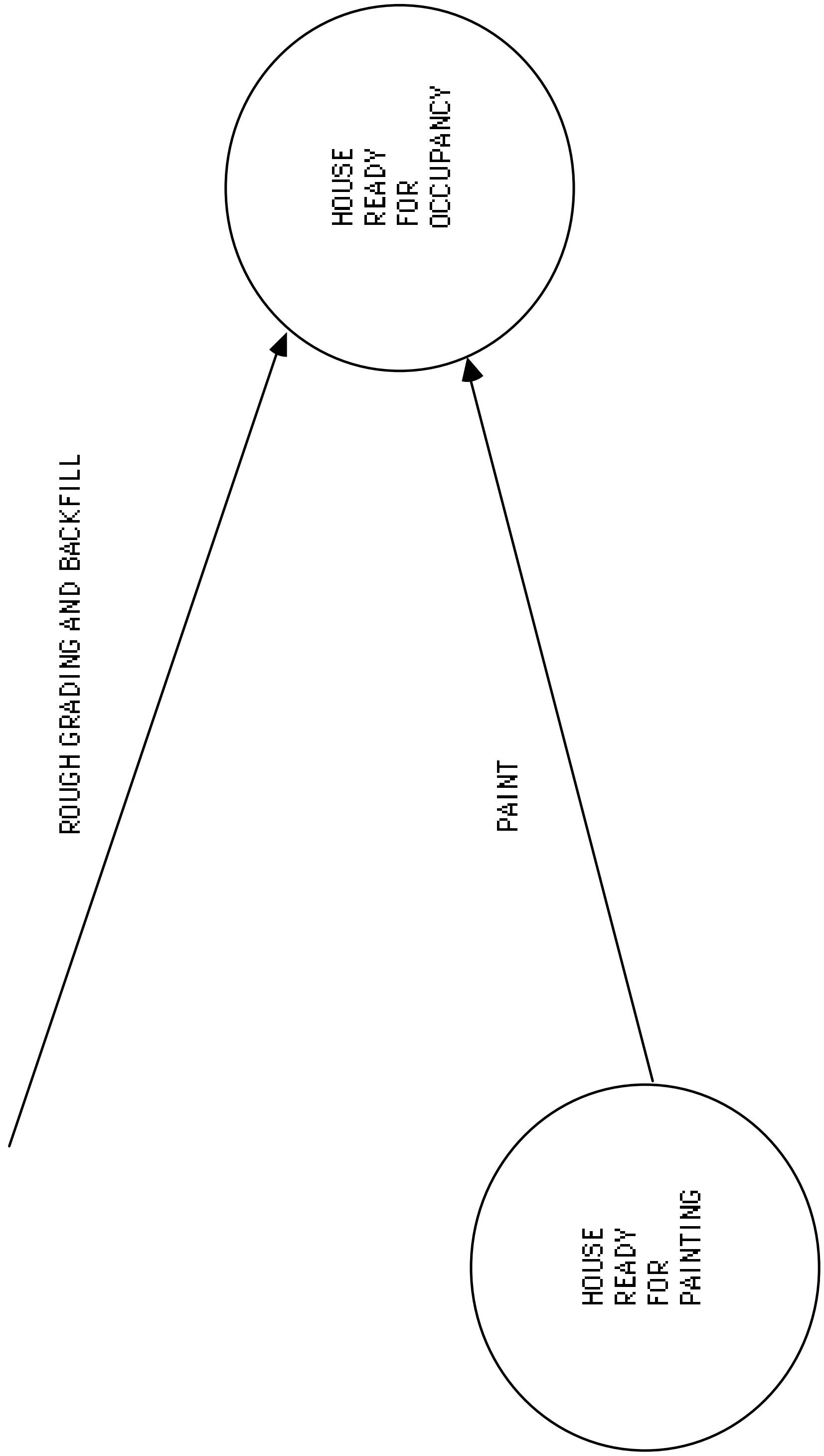


FIGURE 5

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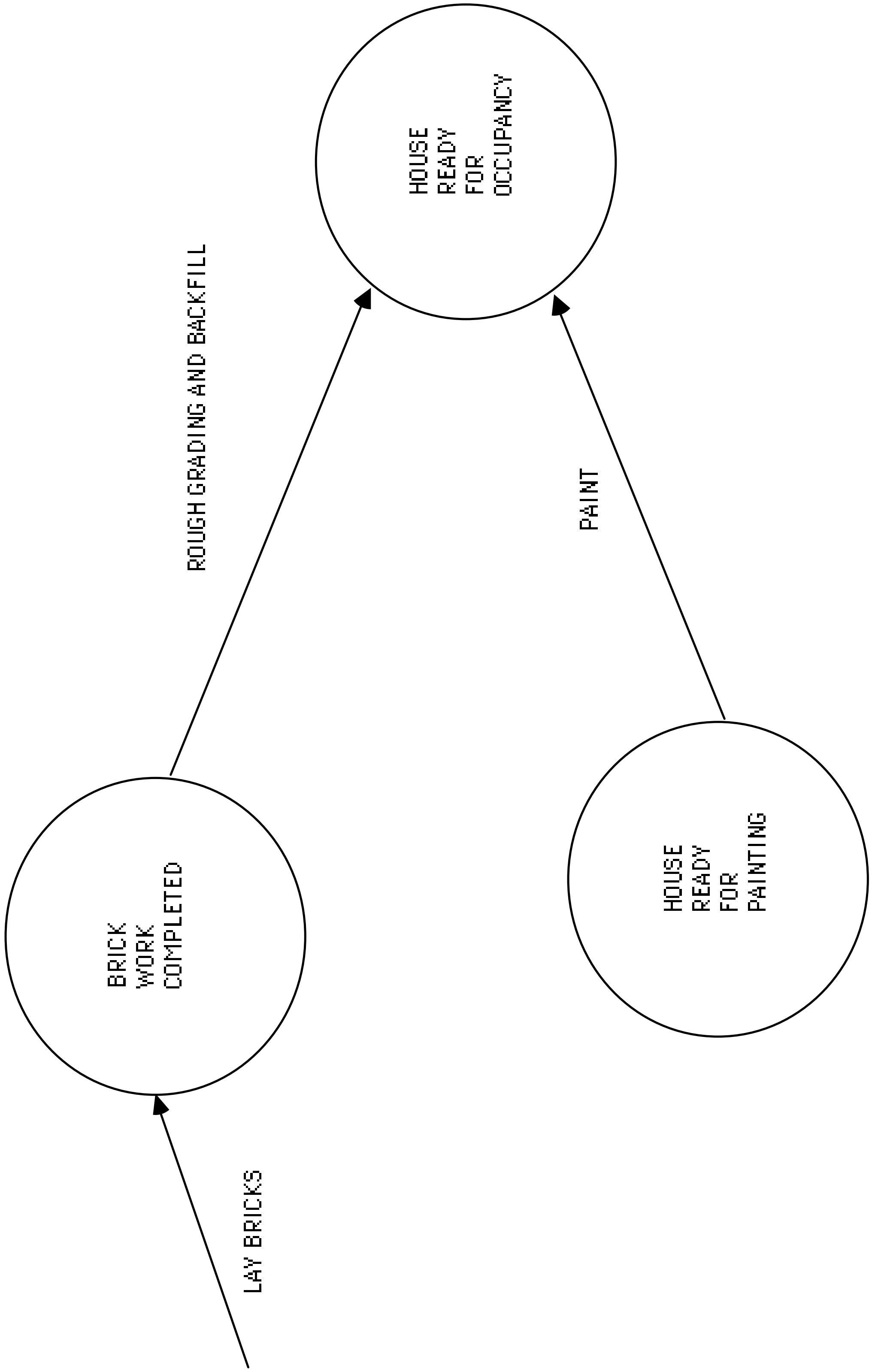
HOUSE READY FOR OCCUPANCY
ROUGH GRADING AND BACKFILL
PAINT
BRICK WORK COMPLETED
HOUSE READY FOR PAINTING
LAY BRICKS

FIGURE 6

Before grading can begin, all the brickwork must be completed. The brickwork can be performed independently of the other elements to this point. However, before the house can be painted, the brickwork must be finished. Therefore a restraint exists between the events 'Brickwork Completed' and 'House Ready to be Painted', thus a dummy activity must be inserted between them Figure 4.5 illustrates the network to this point.

In addition to the completion of the brickwork, the house will not be ready to be painted until the fixtures are installed and the house is trimmed-out. The trimming-out of the house cannot begin until the plastering is complete. Both the plastering and the installation of the fixtures may be carried out at the same time, but, neither can begin until the lathing is completed. These activities and their relationships are added to the existing network. This is illustrated in Figure 4.6.

Before the bricks may be laid or the lathing installed, the house must be roughed in. But before the house may be roughed in the frame must be erected and the foundations laid. The network is now completed by the insertion of these activities. Figure 4.7, therefore illustrated the network as it appears for the entire project at the completion of the first part of the planning stage.

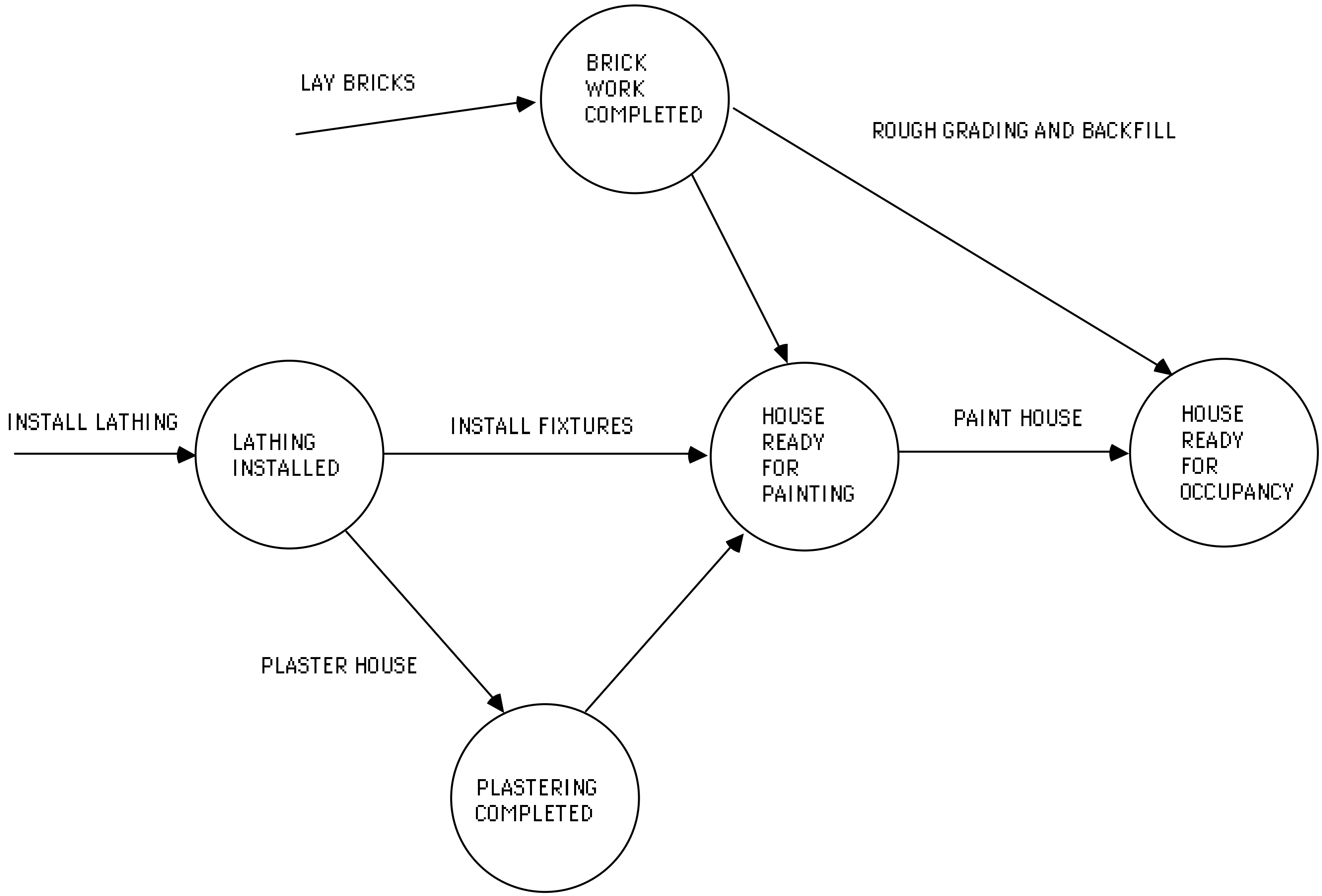
LAY BRICKS
BRICK WORK COMPLETED
ROUGH GRADING AND BACKFILL
INSTALL LATHING
LATHING INSTALLED
INSTALL FIXTURES
HOUSE READY FOR PAINTING
PAINT HOUSE
HOUSE READY FOR OCCUPANCY
PLASTER HOUSE
PLASTERING COMPLETED

FIGURE 7

In the previous example two notations were used to describe the elements of the network. firstly, the events were described, i.e. 'plastering completed' etc., note that an adjective was used in the description. All events are either 'job started' or 'job finished'. Secondly, the activities themselves were described, i.e. ' install fixtures' etc., note that a verb is used to describe an activity.

Both these notations have their advantages, normally one or other is used in the description of the network elements. However, the most common practice is to use activity notation, as it is simpler and takes less space. The MICRO PLANNER system handles both notations equally well.

As the activity notation is used more commonly, we must number the events in a network in order that analysis of it may be made easier. The numbers do not need to be in any numeric sequence or necessarily numeric. The Micro Planner X-Micro Planner system permits use of up to eight (8) alphanumeric characters to number an event. These may be in a random order.

This randomness facilitates easier insertion and deletion of activities in a network. In previous systems of numbering strict numerical sequence had to be maintained. This led to great difficulties in the updating of a network, and so errors were introduced thereby invalidating the network.

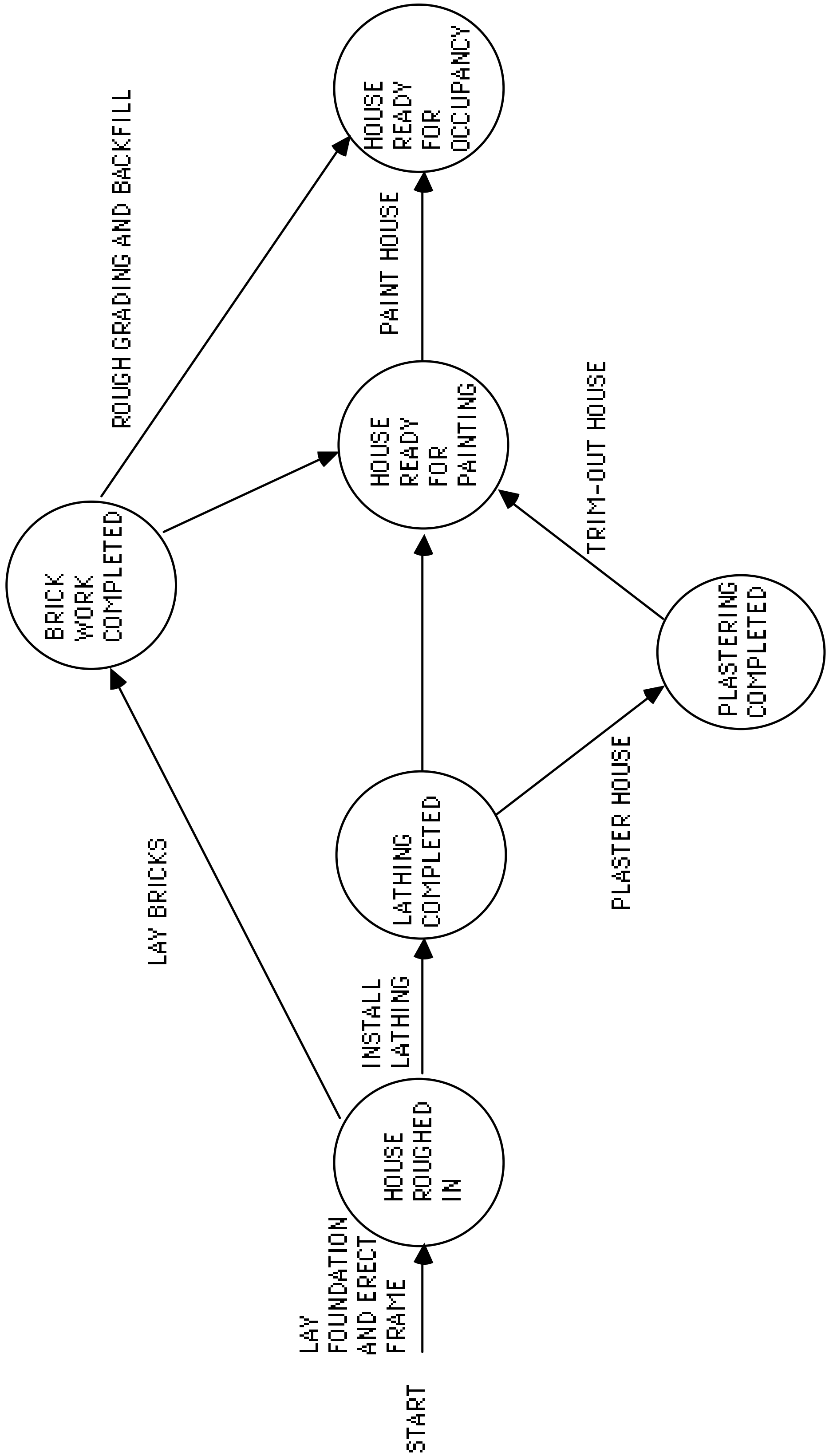
START
LAY FOUNDATION AND ERECT FRAME
HOUSE ROUGHED IN
INSTALL LATHING
LAY BRICKS
LATHING COMPLETED
BRICK WORK COMPLETED
PLASTER HOUSE
PLASTERING COMPLETED
TRIM-OUT HOUSE
HOUSE READY FOR PAINTING
ROUGH GRADING AND BACKFILL
PAINT HOUSE
HOUSE READY FOR OCCUPANCY

FIGURE 8

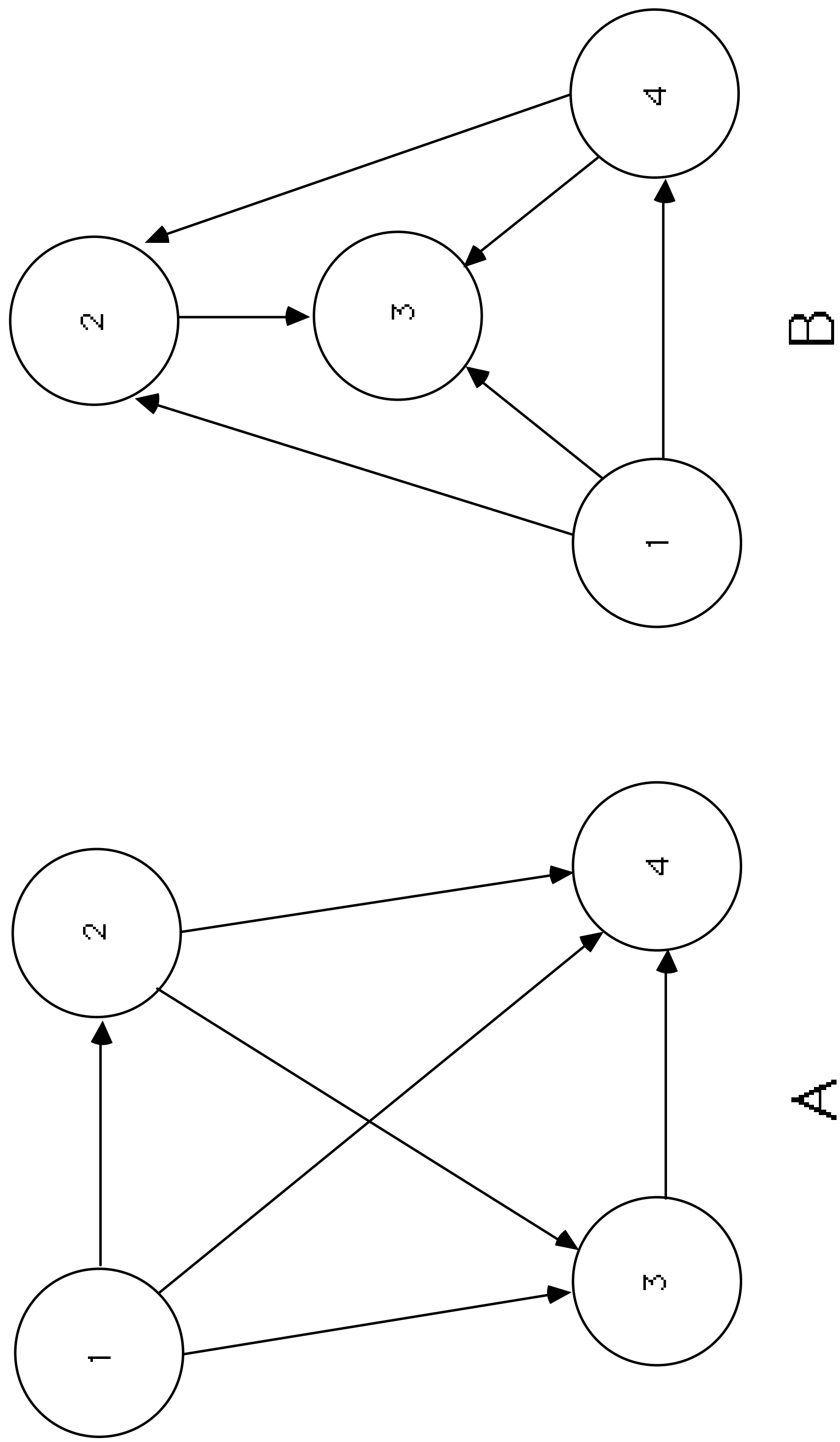

FIGURE 9

Hints for Drawing Networks

It is often difficult to draw a neat network which is easy to follow, when the number of activities becomes large. Practice helps one to develop an 'eye' for constructing networks. The following hints based on experience may be helpful. In each illustration, network (b) is self-evidently to be preferred to network (a).

1. Try to avoid drawing activities which cross each other.

2. Try to keep all activities as straight lines.

3. Try to keep the angle between the activities as large as possible.

4. Try to keep a left to right component in each activity, in other words, always draw a later activity, in other words, always draw a later event to the right of an earlier one.

5. Avoid unnecessary dummies.

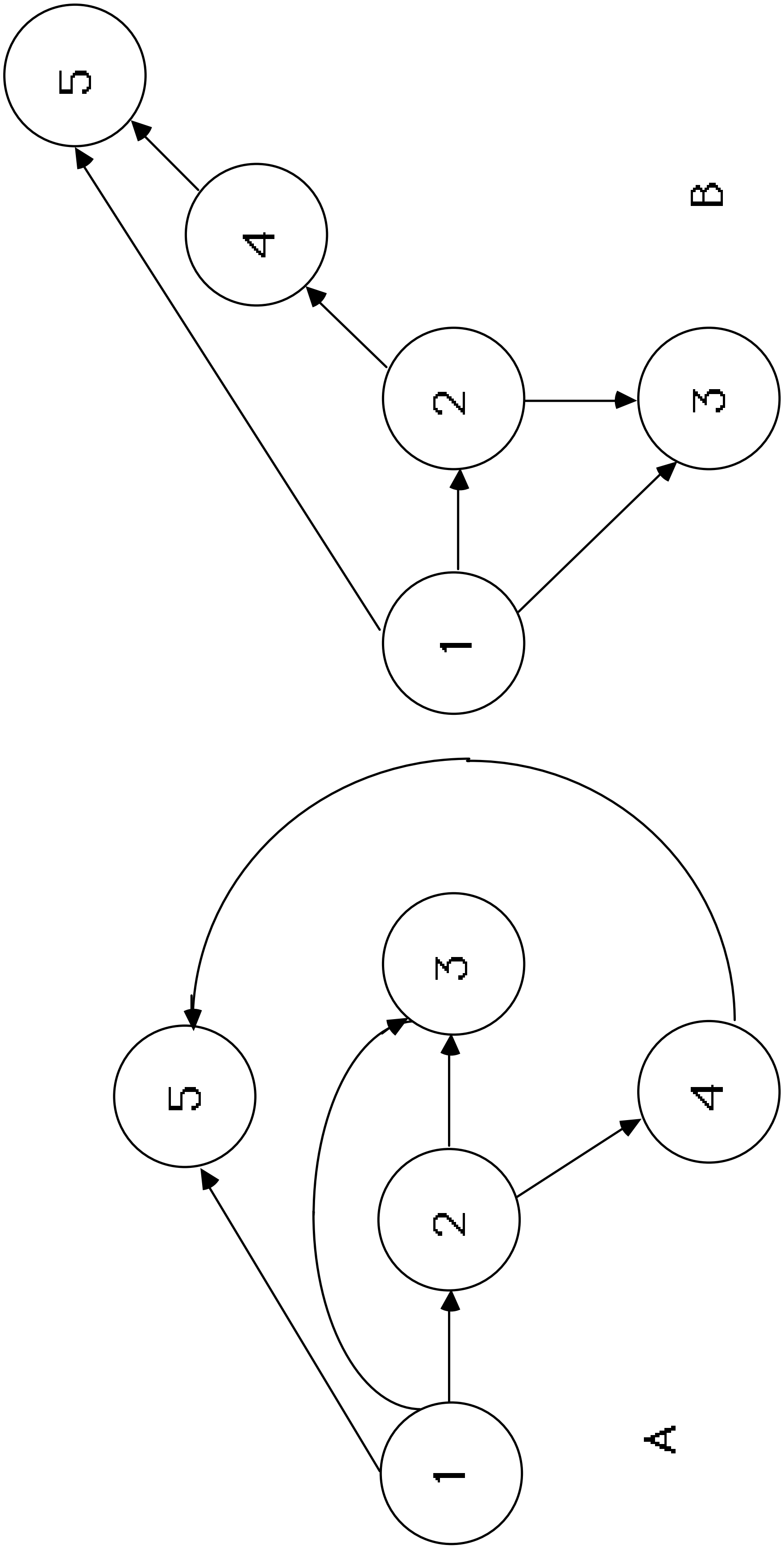

FIGURE 10

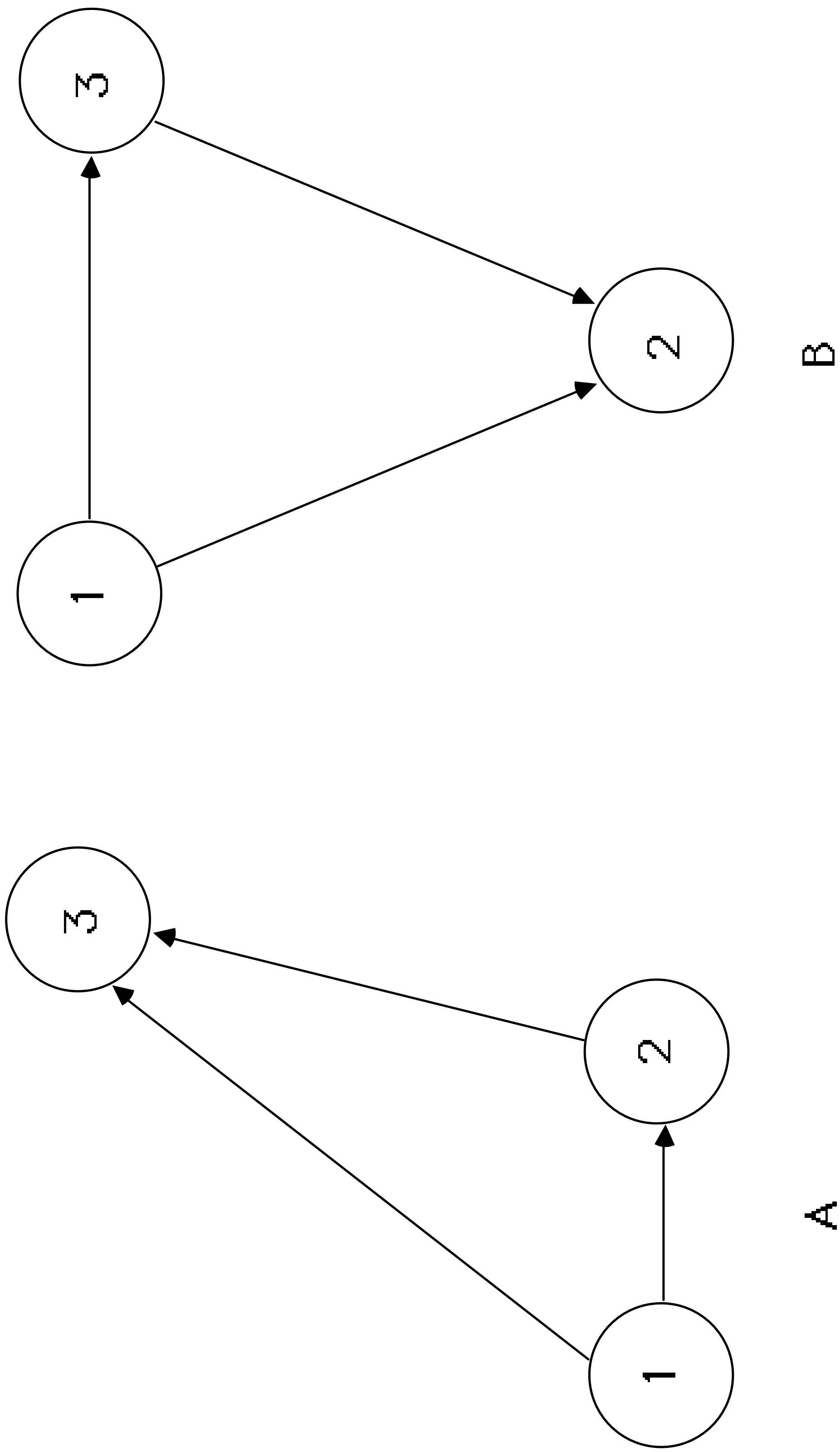

FIGURE 11

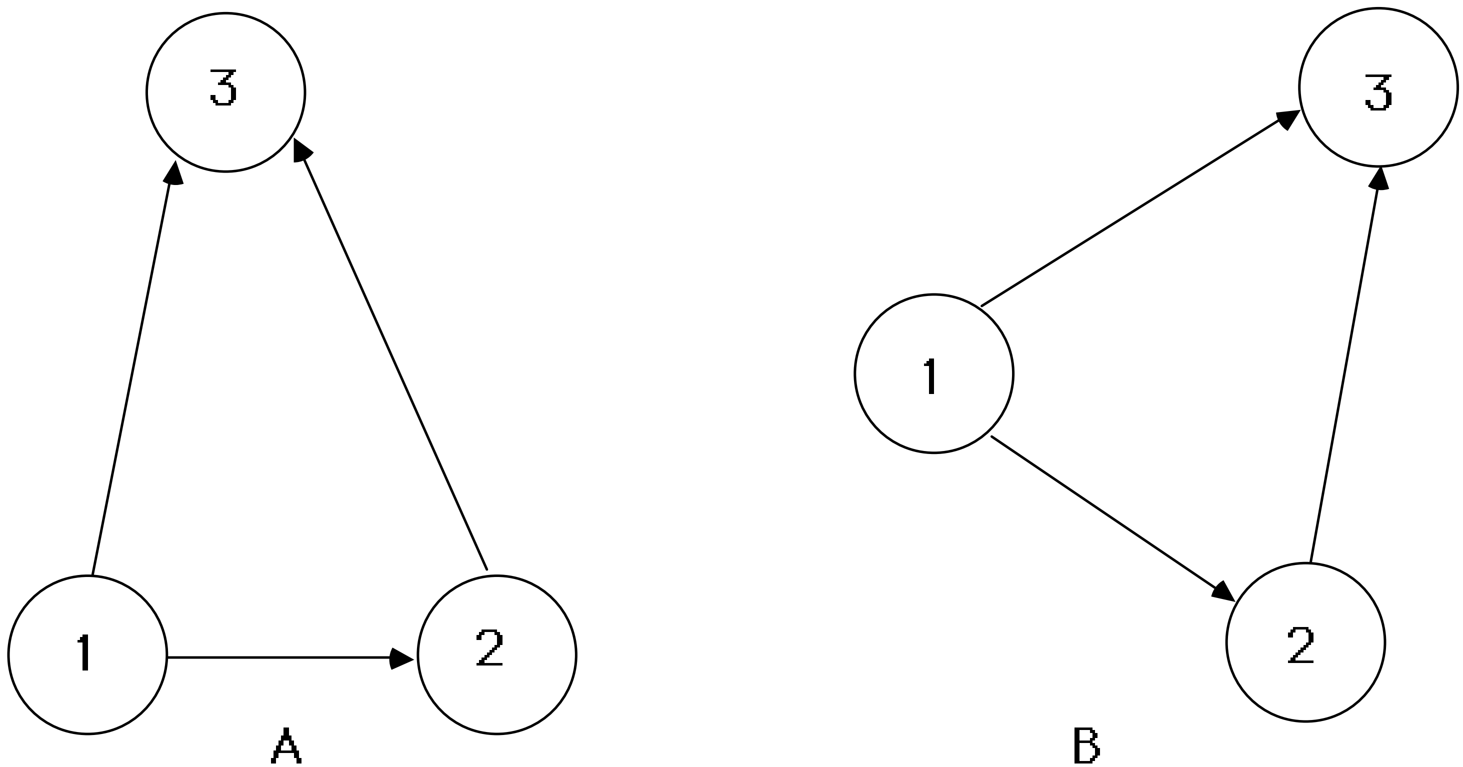

FIGURE 12

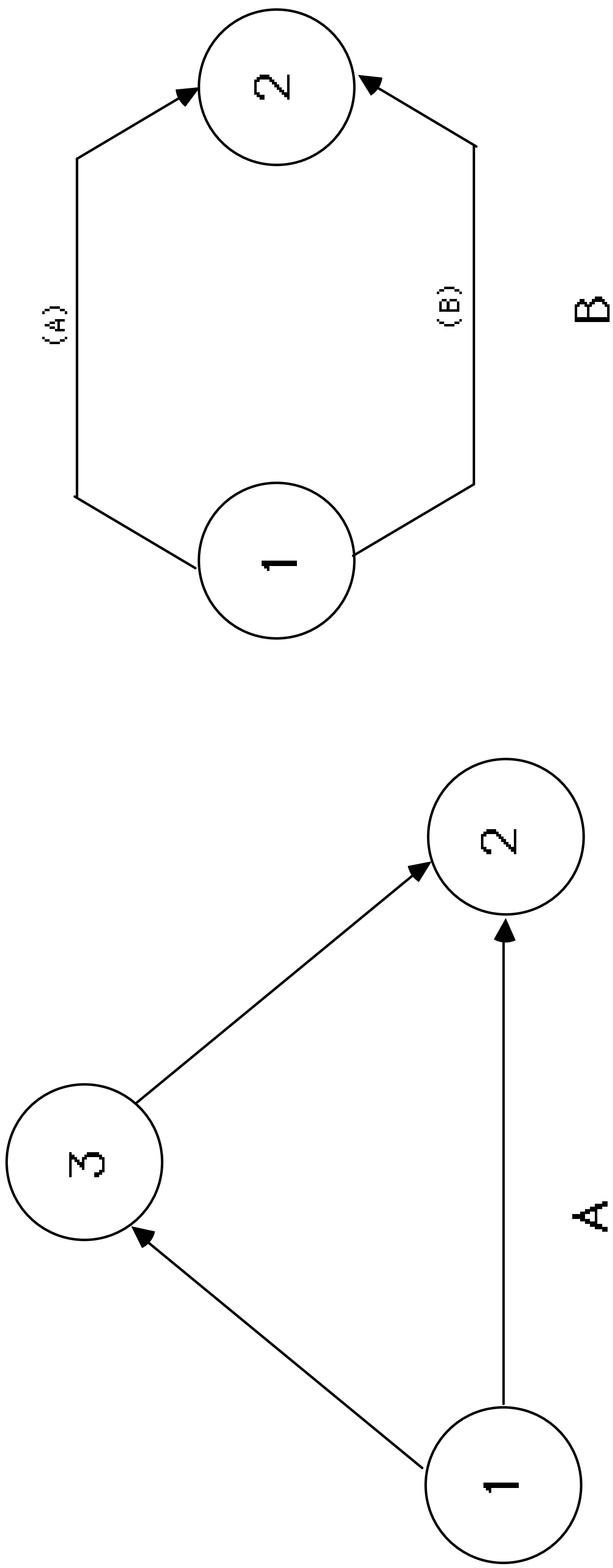

FIGURE 13

CHAPTER 2 - SECTION 5

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

TIME ESTIMATES

A major element in the successful use of MICRO PLANNER for a particular project is the control data to be used by the people who will estimate activity time on the MICRO PLANNER network.

1. Control Data for Estimating Times

   The following control data is considered essential.
   First, a detailed written description defining the specifications of the project as known at that time. The group of people who make up the MICRO PLANNER team represent various operating functions of their company, when they are brought together for the purpose of estimating activity times on a project, must have a common unit of specification data or their time estimates will be meaningless and valueless. As the specification is further refined or altered, it is essential that the activity times be reviewed and altered accordingly.

   Second, the resource capacity which will be made available for this project must be identified. Resource capacity, as used throughout this book, consists of the four basic economic elements; men, money, materials, and machines. The MICRO PLANNER team must have a common criteria on governing the allocation of resources in order that their activity times estimates have a meaning. The usual procedure is for Top Management to indicate the amount of resources which it is estimated can be made available for this project.

   As an example, let us assume that in the XYZ Company thirty per cent of the existing resources, department by department, are to be used in 'estimated' times for a project. This means that on a departmental basis seventy percent of each department's resources will be used on regular everyday work, i.e. the completion or continuing-on of existing projects. Later, if resources are varied for any reason, then the activity times must be reviewed and the network times reprocessed to assess the effect (if any) on the total project.

   Third, the number of units in the first batch, (or quantity) of objects to be build etc. must be known. This is in order that material requirements can be met, sufficient tools can be made, the proper amount of labour trained and allocated, etc.

   A fourth item of control data needed to estimate is the target delivery date by which Top Management would like to see delivery achieved. A realistic time span by a conscientious management serves as a cohesive device in keeping all times estimated within the same boundary lines. these four items are considered essential in guiding the MICRO PLANNER team who make the MICRO PLANNER time estimates.

2. Estimating Times for all Activities

Usually a one-time estimate, known as the 'Most Likely' time is applied to an activity. This generally means that all things being equal this will be the most likely time that the activity will take to completion. Nearly all activities in a network can have a one-time estimate assigned to them. However, there are occasions when there is uncertainty about the duration of an activity due to several criteria. To overcome this problem, a three-time estimate will be assigned to that activity. These three-time estimates are known as (a) 'Pessimistic', (b) 'Most Likely', and (c) 'Optimistic', times.

The 'Pessimistic' time is that time the activity will take assuming all the worst possible happenings on the project occur; usually a 1 in 100 chance.

The 'Most Likely' time has been previously defined in Paragraph 5.2.

The 'Optimistic' time is that time the activity will take assuming everything goes unusually well; again a 1 in 100 chance.

These three-time estimates are then computed to give a weighted single time estimate. The method by which this weighted single time is computed is the standard beta distribution curve. This is:

$$\frac{a + 4b + c}{6} = Te$$

where a = Pessimistic Time
b = Most Likely Time
c = Optimistic Time
Te = Expected Time

CHAPTER 2- SECTION 6

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

THE MICRO PLANNER CALCULATION

In a MICRO PLANNER network, the longest path in terms of time is known as the 'Critical Path'. This path is obtained by the addition of all activity times which have been estimated along each and every path in the network. The calculations by which these paths are computed are described in the succeeding paragraphs.

1. Event Calculations

   Event Early Schedule
   Time (EES) is the earliest that succeeding activities may start.

   Early Time
   (ET) is the earliest that succeeding activities may start, based on ALL previous Management Impositions (M.I.).
   (M.I.'s are imposed schedule dates).
   ET = Max (EES, ESS +

   Late Event Schedule
   Time (LES) is the latest that the succeeding activities may start.

   Late Time
   LT is the latest that the most critical succeeding activities may start.
   LT = Min (LRS, LES =

   Slack
   (SK) is the amount of time that an event occurrence may be delayed from its earliest time.
   SK = LT,

2. Activity Calculations

   Earliest Start Schedule time (ESS) is the earliest that an activity may start.

   Earliest Start
   (ES) is the earliest that an activity may start, based on all previous MI.
   ES = Max (EES, PPE)

   Latest Finish Schedule
   Time (LFS) is the latest that an activity may finish.

Latest Finish
(LF) is the latest that an activity may finish, based on all Subsequent MI.
LF = Min (LFS, SEL)

Latest Start
(LS) is the latest that an activity may start.
LS = LF - A
or LS = PEL
(for activities designated L)

Earliest Finish
(EF) is the earliest an activity may finish.
EF = ES + A
or EF = SEE
(for activities designated L)

Total Float
(TF) is that amount of time available from earliest start, in addition to the estimated activity time, that may elapse without violating any management impositions.

TF = LF - (ES = A)

This includes the waiting time due to uneven work load on a ladder.

Early Free Float
(EEF) is that amount of time available from the earliest start, in addition to the estimated activity time, that may elapse without affecting the earliest times of any subsequent activities or events.

EFF = Min (LF, SEE) - (ES + A)

Late Free Float
(LFF) is that amount of time available from the preceding event latest, in addition to the estimated activity time, that may elapse without affecting or violating any management impositions.

LFF = LF - A - Max (PEL, ES)

Independent Float
(IF) is that amount of time available from the preceding event latest, in addition to the estimated activity time, that may elapse without affecting the earliest times of subsequent activities and events.

3. Example Calculation
To show how a network is analyzed an example will be calculated.

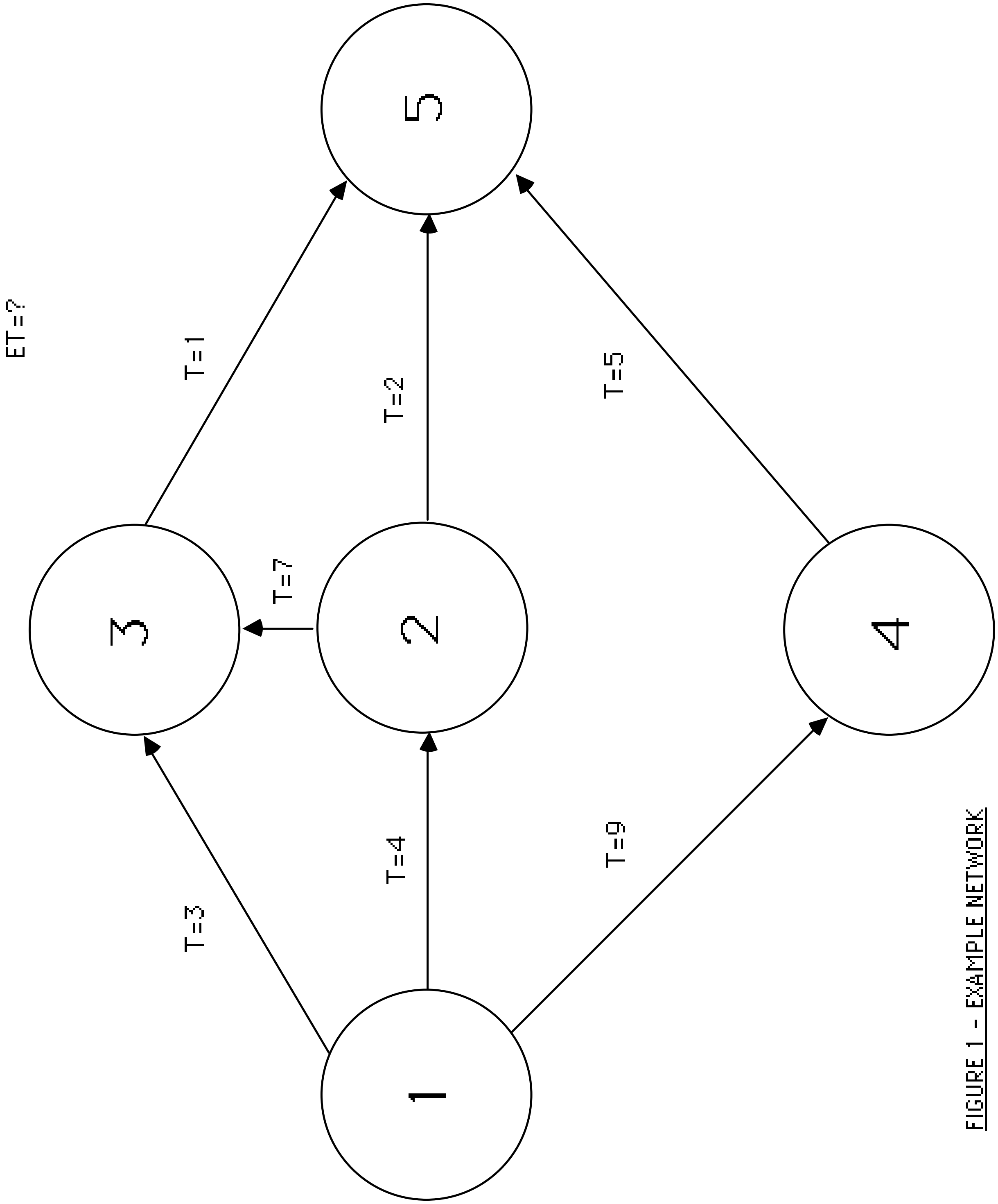

FIGURE 1 - EXAMPLE NETWORK

To determine the earliest finish date of event 5 (the end of the network), all the estimated activity times must be summated along each path. There are four paths leading to 5:

1 to 3 to 5	3 + 1 = 4
1 to 2 to 3 to 5	4 + 7 + 1 = 12
1 to 2 to 5 and the sum or t for each part is:	4 + 2 + 6
1 to 4 to 5	9 + 5 + 14

ET then, is equal to the largest sum, namely 14.
Since all paths leading to event 5 must be completed before event 5 is achieved, then the longest elapsed time determines when event 5 will be attained; other paths of activities will be accomplished before and concurrently with the longer path.

In the summation of the activity times along the paths indicated, it should be noted that path 1 - 3 - 5 is not a real possibility; at least it is not possible as stated. Event 3 cannot be attained simply by completing activity 1 - 3, but requires that activities 1 - 2 and 2 - 3 also be completed. Therefore, 11 units of time must be expended, rather than 3 to accomplish event 3.

Since this is the case, it is impossible to reach event 5 in 4 units of time as shown above. This illustrates the fact that in computing ET for all the events in the network, the ET's for the earlier events must be calculated prior to the ET's for the later events.

Accordingly if the ET's were calculated for all events in the network shown in Figure 6.1, the results would be:

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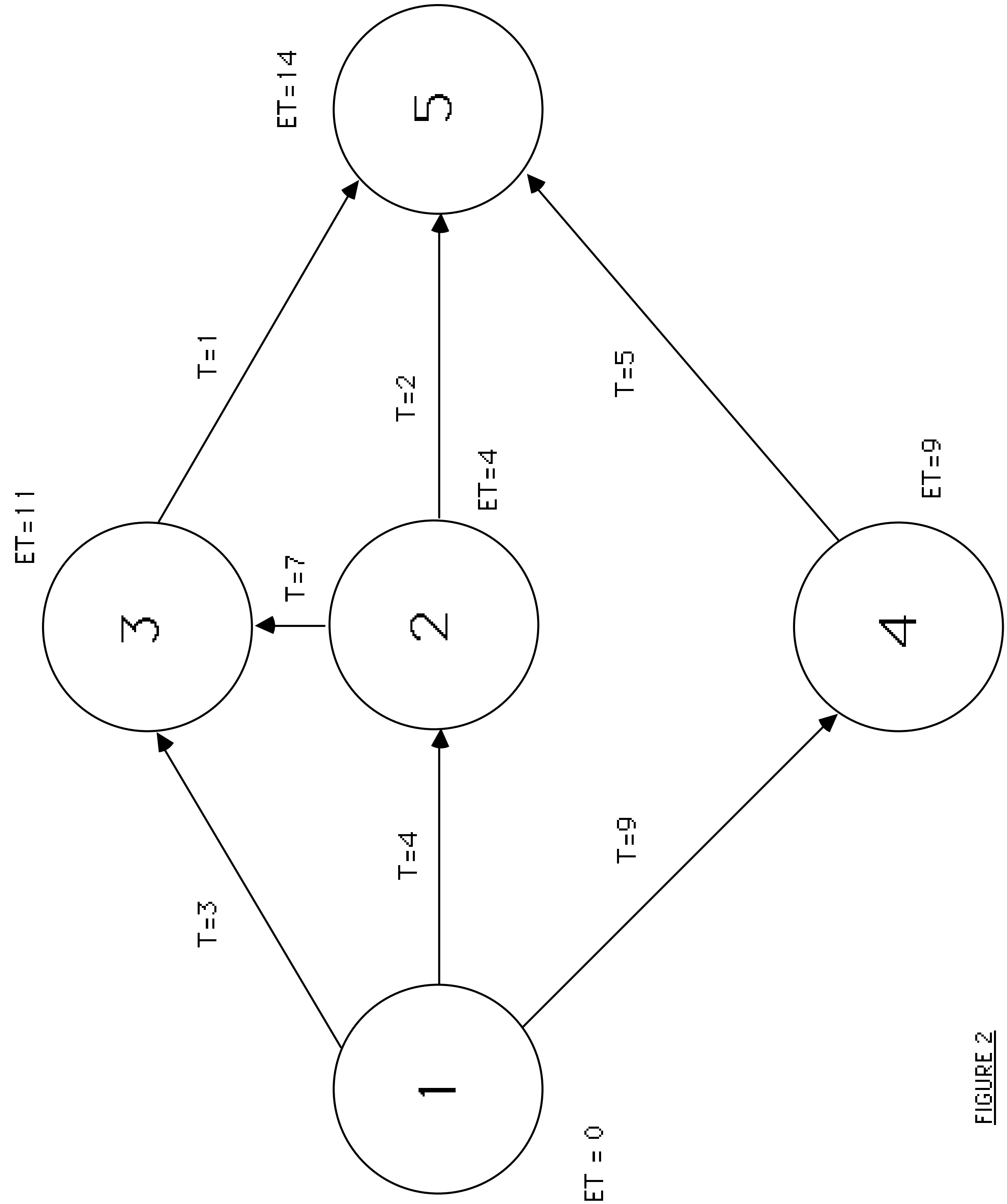


FIGURE 2

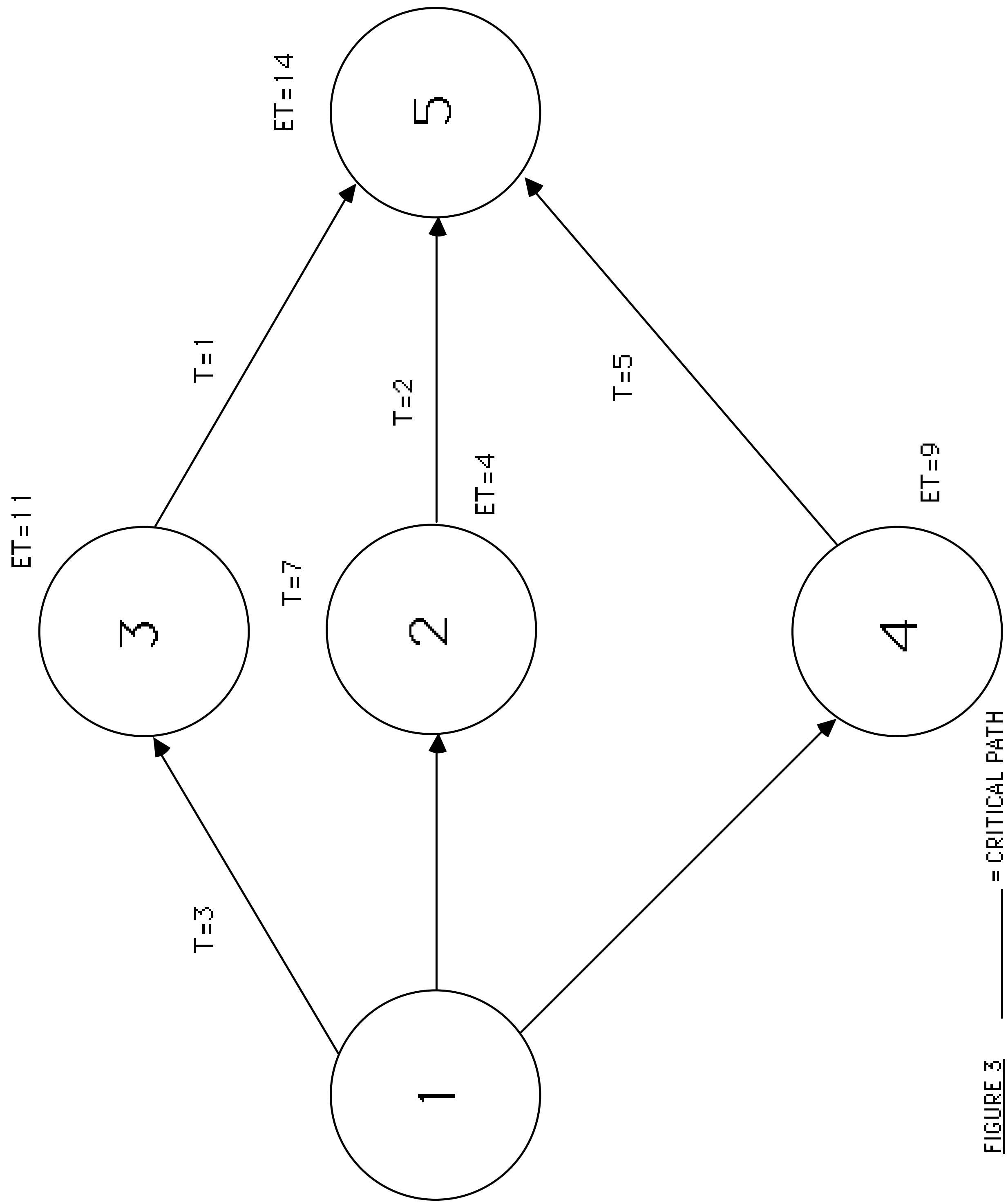


FIGURE 3

It has been previously stated that the longest path in terms of time is known as the Critical Path.
This is the path with the greatest time constraint on the end event, so it will determine the date upon which the end objective can be obtained. If any activity on this path requires time in excess of its original estimates, the entire program will be delayed by this amount. In the network shown in Figure 6.3, the Critical Path is form 1 to 4 to 5.

On the remaining paths there is 'time to spare', or float at least relative to the end objective. These paths are called float paths. In order to compute the amount of float for each path, it is necessary to determine the latest time at which the path can be completed without itself becoming critical. If the expected time (ET) for each event is subtracted from the latest time (LT) for each event, then the amount of float for each event is determined.

Suppose it was decided that the expected time for event 5 was also the latest time that project conditions would allow it to be obtained. The determination of what is the latest allowable time is an arbitrary decision made independently of the network by ?Top Management. Suppose that LT - ET. Then LT for each event can be calculated by applying the following rules:

(1) By subtracting the activity duration (t) from the LT of its succeeding event, the LT of the preceding event is obtained. In the network shown in Figure 6.4, the activity duration of Activity 4 to 5 (t = 5) is subtracted from the latest allowable time of event 5 (LT = 14) to arrive at the latest allowable time for event 4 (LT = 9)

(2) Where there is more than one path leading back to an event, more than one LT is obtained. The smallest value is the correct one. This is true at event 2 in the network shown in Figure 6.4, where there is a path from event 5 back to event 2, and another path from event 5 back through event 3 to event 2.

In the sample network, if rules 1 and 2 are applied, LT for each event would have the following values.

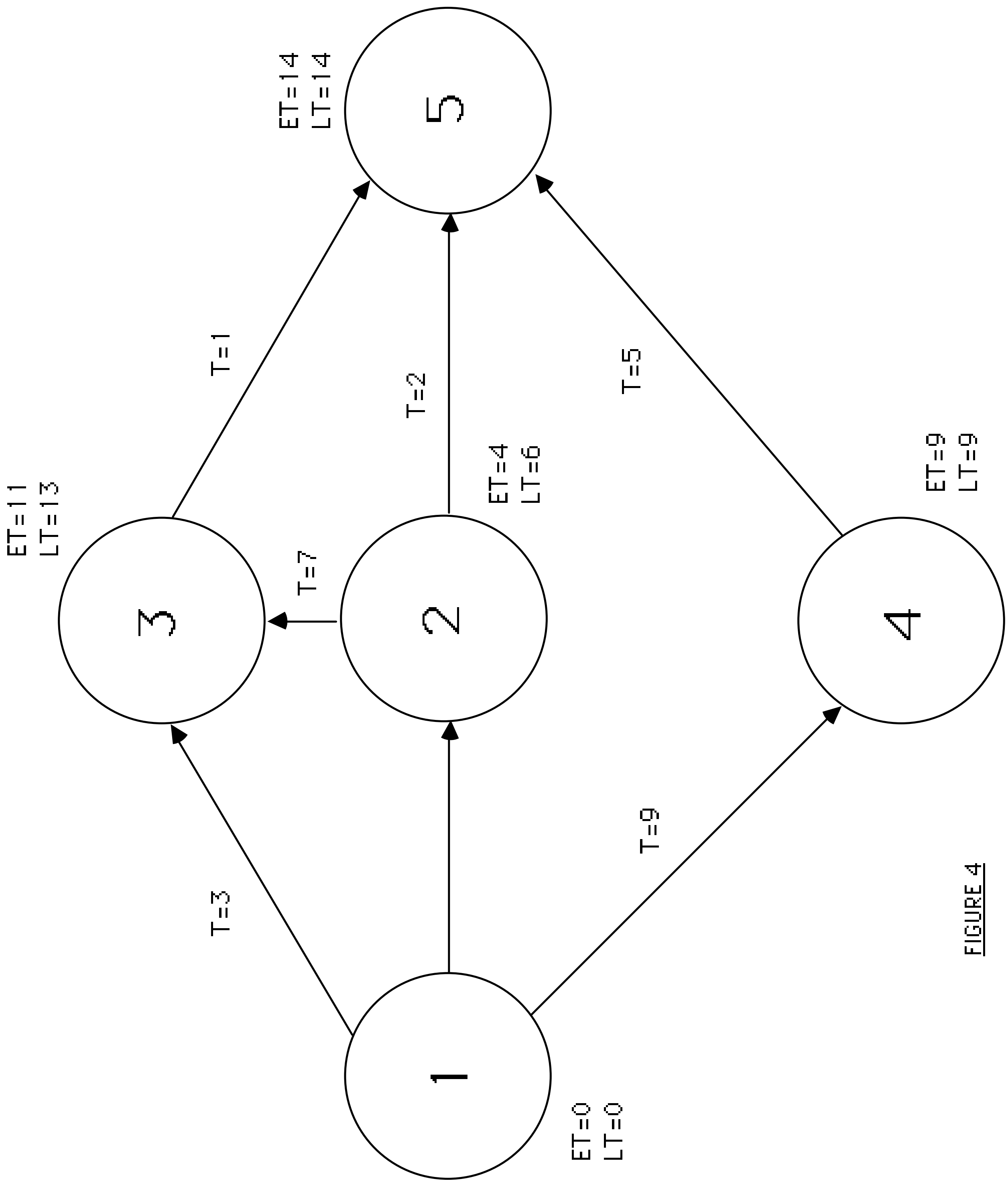

1
2
3
4
5
ET=0
LT=0
ET=4
LT=6
ET=11
LT=13
ET=9
LT=9
ET=14
LT=14
T=3
T=9
T=7
T=1
T=2
T=5

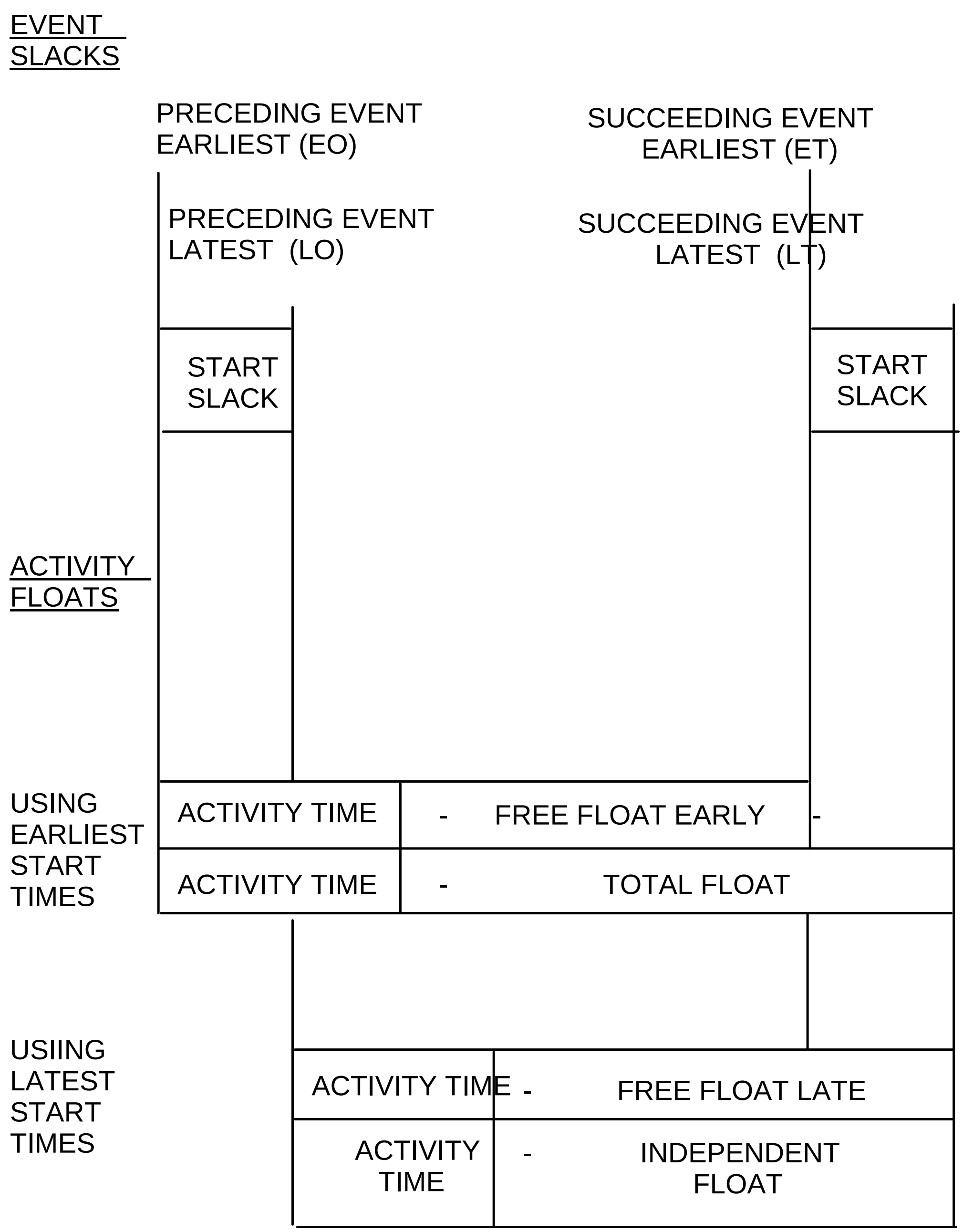
FIGURE 4

Having determined LT for each event, it is now possible to determine slack for each event. Slack is equal to the difference between LT and ET i.e., slack = LT - ET for any event. Slack values for the network shown in Figure 6.4 are as follows:

EVENT	LT	ET	SLACK (LT-ET)
1	0	0	0
2	6	4	2
3	13	11	2
4	9	9	0
5	14	14	0

Note that event 1, 4 and 5 have no slack; this equates to stating that they are on the Critical Path. Therefore, if they are not accomplished by the expected time, not only they, but the entire project will become delayed.

DIAGRAMMATIC REPRESENTATION OF SLACKS AND FLOATS



CHAPTER 2 - SECTION 7

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

THE CRITICAL PATH AND ITS USE

In general, the importance of critical path determination is to focus management attention upon those activities which are the determining factors in the timely accomplishment of the project. In a large complex project these factors are difficult to isolate and as a result non-critical tasks are needlessly emphasized or critical task are over-looked. Moreover, with frequent project changes, the critical path may change from one area to another. MICRO PLANNER assures that the time significance of project changes does not go unnoticed.

1. Project Evaluation

In evaluating progress of the implementation of a plan, the manager must be able to answer the questions "Where are we?" and "Where are we now?". He m, obtain accurate information as to the true status of the project, whether problems exist and what they are. He must be able to determine the gravity of the problems in order to assign a priority to their solution.

Since most MICRO PLANNER systems are cyclic in nature, they produce information which indicates that at a given time work along a particular path in the network has progressed to a discernible point. This point indicates the status at present of the path and the combination of similar points on all paths will show the status of the entire project at a given point in time. This status is depicted on the network and is the subject of reports prepared by the Micro Planner software. In the Micro Planner system there is provision for inserting actual completion information in the calculations to increase the accuracy and reliability of the status gathering function. As this completion information is merged with the estimated information, it is probable that the Critical Path will change. If it does not, then the project is holding its own, but should it change then the manager must reorganize his priorities in order that the original plan is maintained.

Although Micro Planner provides valuable information to the analyst and manager throughout its function, as a status gathering system. this is not its prime value in the evaluation of the program.

Of greater significance is its use as a diagnostic tool in detecting problem areas where improvements could be made.

By describing the critical path of activities leading to the final event and by determining the relative constraining influence of each other activity on the completion of the project, MICRO PLANNER appraises the manager of these activities which required his closest supervision and defines areas where resources may exist which could be used to greater advantage elsewhere in the project.

CHAPTER 2 - SECTION 8

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

REDUCTION OF THE CRITICAL PATH

When a network has been analysed for the first time, Management may not accept the end date that has been .calculated. In fact, quite often the Critical Path is too long because the estimators have allowed themselves more time than is necessary, to ensure that they can meet the required dates. As a result Management insists on a reduction of the Critical Path.

1. Initial Assumptions

   In order to illustrate the procedure for reducing the Critical Path the following assumptions have been made:

   (a) The Company has not used MICRO PLANNER previously
   (b) The Company have a Project Definition and a Project Specification Book
   (c) A network has been drawn for this project.
   (d) Based on the Specification Book the activity times have been estimated.
   (e) Time data has been processed either manually or by computer and tabulations obtained.
   (f) The Critical Path has been plotted on the network.
   (g) Analysis has been carried out and the decision made that the Critical Path must be reduced.

2. The Procedure

   Decide by how much time the Critical Path must be reduced to meet management requirements, e.g. three weeks.

   There will be several paths of varying amounts of Total Float that are equal to and less than three weeks in value.

   Plot each of these paths on the network with the aid of the Activity Print-Out sequenced by Total Float
   (Note: The paths are not necessarily continuous).
   It is easier if each level of float was plotted using different colours.

   With the aid of the Project Specification Book examine the activity times along the Critical Path, i.e. the path with zero Total Float.

   First examine those activities with the longest times and determine whether they can be reduced. Thus re-estimate all those activities where reduction is possible until a three week reduction has been achieved.

Consider now those paths with total Float between zero and three weeks, i.e. the sub-critical. The activities on these paths should now be examined for possible reduction. The minimum amount to be achieved to guarantee the three weeks is the amount the Total Float is less than the three weeks. The reason being, the sub-critical become critical as the time on the Critical Path is reduced.

3. Example

On the XYZ Company MICRO PLANNER network, activity 64 - 72 is on the Critical Path, and has an estimated time of 20 weeks. It has been decided, (as a result of further MICRO PLANNER team meetings), that this activity can be accomplished in 17 weeks, giving a three week reduction.

However, the three week reduction to the total project time has not been achieved until the sub-critical paths have been reduced.

The following is a list of the sub-critical paths (assume a five day working week).

PE	SE	Amt of Float (WKS)	Path	Reduction Required (WKS)
53	54	1.0	A	2.0
57	62	1.0(	B	2.0
62	71	1.0(		
55	62	1.0	C	2.0
63	66	1.0(		
66	81	1.0(	D	2.0
81	89	1.0(		
89	101	1.0(		
21	28	1.1	E	1.4
23	30	1.1	F	1.4
4	19	1.1(		
19	26	1.1(		
26	30	1.1(	G	1.4
30	28	1.1(		
28	46	1.1(		
45	49	1.2(	H	1.3
49	57	1.2(		
4	10	1.3(		
10	18	1.3(		
18	24	1.3(	I	1.2
24	31	1.3(		
31	36	1.3(		
36	46	1.3(		

Note: The list of the sub-critical activities given is grouped by 'path'. The reason being that, it is on the path that a reduction has to be made and any one activity on that path may be reduced.

4 Amendments

When using a computer to process the network, all records that need amending are amended and the network reprocessed. If being processed manually the network needs re-analysing with the amended data and new tabulations prepared.

5. Review

The new Critical Path is plotted and its should confirm that the overall project time has been reduced by the three weeks required.

Any further reduction required can be obtained by repeating the procedure outlined in paragraphs 8.2 to 8.4.

From the procedure given in paragraph in paragraphs 8.2 to 8.4 it will be realised that it is essential to achieve the full amount of reduction on the Critical Path. On the sub-critical paths however, the reduction as indicated in the above procedure may not be required, this is actually dependant upon whether the sub-critical path is sequential or in parallel with the reductions made on the Critical Path.

The true requirement being to examine every different path from Project Start to Project Finish formed by the coloured paths plotted with each of these paths a three week time saving including Total Float must be found.

Total Float is the measure of Float relative tot eh End Date of the Network. Any time over and above the activity time consumes Total Float time, and any time over and above the Total Float time will change the end date of the Network by an amount equivalent to the excess.

Early Free Float is to the Succeeding Event Earliest Start as the Total Float is to the End Date. Thus, any time over and above the activity time consumes Early Free Float time, and any time over and above the Early free Fl;aot time will change the Earliest Start of the Succeeding Event, but not necessarily the End Date of the Network.

Appreciation of the effect of changes on these two important floats will allow one to appreciate the changes to the overall network being made with activity time reductions.

An alternative way of achieving time reduction is to examine the Critical Path activities as indicated by the `Total Float' printout from the viewpoint of making them parallel rather than sequential. This examination can of course be carried out on any path, the gain in time on that path being the activity time less the total float time for that activity.

CHAPTER 2 - SECTION 9

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

PROGRESSING

1. One of the most important advantages of MICRO PLANNER lies in its use for keeping control of a project whilst it is in progress. As the project proceeds, four kinds of changes to the network will arise:-

   (a) **Revision of methods of operation -** When the original planning is done some activities will not be know in detail since they will not happen for many months. As the project progresses these details will become known and the original network may require considerable revision.

   (b) **Revision of Time Estimates -** More precise estimates of times required for operations will become more evident as the project progresses: Any three-time estimates that were estimated because of uncertainty, may be reduced to a one-time estimate.

   (c) **Activities are completed and Events -** This will be recorded by feed back from those actually controlling the project. It is essential that proper communications be set up in order to obtain feed back on project progress, otherwise the network rapidly falls out of date with actuality, and thereby is rendered impotent. This has happened often in the pat, resulting in the MICRO PLANNER technique being used as a scapegoat for alleged project failure. The real culprit being lack of proper communications on Activity completions and Event achievements.

   (d) **Scheduled Dates may be added -** New delivery promises or notification of delays may arise and it becomes necessary to make a quick assessment of the effect of these on the planning and project to date.

      1. These changes may cause new activities and events to become critical, (in fact, most probable), and a re-assessment of the project method or allocation of resources may be necessary to ensure the completion of the project on time. Equally important is the fact that a late activity may have no effect on lengthening the overall project time. It is immediately obvious that no action is necessary.

         Before MICRO PLANNER progressing was available, it was practice to speed up all the remaining activities if an activity or activities were running behind schedule. This was because it was not +- all clear where remedial action was necessary.

Often the result was huge increases in costs due to excessive overtime and as often as not, the project was still delayed. With MICRO PLANNER progressing, corrective action is apparent and no wastage of capital and resources should occur.

Usually, a network is progressed weekly or bi-weekly. However the reporting frequency is dependent on the nature and time span of the particular project.

2. Progressing with Micro Planner Systems

In the Micro Planner Systems all progress data can be added separately from the original network by using a table of progress data. The table can be input directly into Micro Planner or imported from say Excel or another spreadsheet package./ Progress can only be effective if Time now is brought forward, this is achieved by using the PROGRESS DETAILS in the ANALYSIS MENU. Previous progress should have been archived. Progress can also be entered directly on the activity record.

CHAPTER 2- SECTION 10

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

RESOURCES

1. The type of resources:

(1) Men
(2) Machines
(3) Money
(4) Materials

commonly referred to as the 4M's, there is also a resource which is quite often forgotten and that is:

(5) Space

All these different type s of resource can be scheduled by the "Resource Analysis program. To carry out the scheduling the program must be given:

(1) The resource requirement for each activity.
(2) The resources available to the project.
(3) Any management impositions.

2. Resource Requirements

The resource requirements are added to the network in a similar fashion to activity times. Activity requirements are specified by naming RESOURCE CATEGORY and the QUANTITY REQUIRED, which may be a RATE or a TOTAL depending on the resource type. The quantity which is required must be specified whether it is not going to be used continuously on any activity (The program assumes that once a quantity has been assigned to an activity it will be used continuously). Each activity may use any combination of the resources which are available to the project.

A resource may be specified as:

Rate Constant e.g. Fitters required at the RATE of 4 per day for every day they are needed.

Total Constante.g. 10,000 bricks required in TOTAL to accomplish an activity.

N.B. MICRO PLANNER assumes all resources to be RATE CONSTANT. Resources can be considered to be 'simple' or 'complex' according to the matter they are used.

3. Simple Resources

Simple resources are those which are uniformly required over the whole duration of an activity, for example, in a six-week activity requiring 2 brickies, 1 labourer and 5,000 bricks per week (or a total of 30,000 bricks), it will be assumed that these resources will be uniformly required from the start of the activity for each of six weeks until the completion.

4. Complex Resources

Complex resources are those which are not uniformly required over the whole duration of an activity.

Examine the following example:-

A six week activity requiring several resources for only a portion of the activity time; for example:-

10,000 Brickies	(for first 2 weeks)	(Total Constant)
2 Brickies	(for week 1 for 2 weeks)	(Rate Constant)
3 Plasterers	(from week 2 for 3 weeks)	(Rate Constant)
1 Painter	(from week 5 for 1 week)	(Rate Constant)
3 Carpenters	(from week 3 for 3 weeks)	(Rate Constant)
1 Carpenter	(from start to finish)	(Rate Constant)
1 Labourer	(from start to finish)	(Rate Constant)

Shown below is diagrammatic representation of this resource requirement.

BS = Bricks, BR = Brickies, PL = Plasterers
PA = Painter, CP = Carpenters, LB = Labourer

Whenever an activity using complex resources is scheduled, the pattern of resource requirement is always observed. In the above example, during week 3 there must be three plasterers, three carpenters and one labourer available for the work to be schedules during this week.

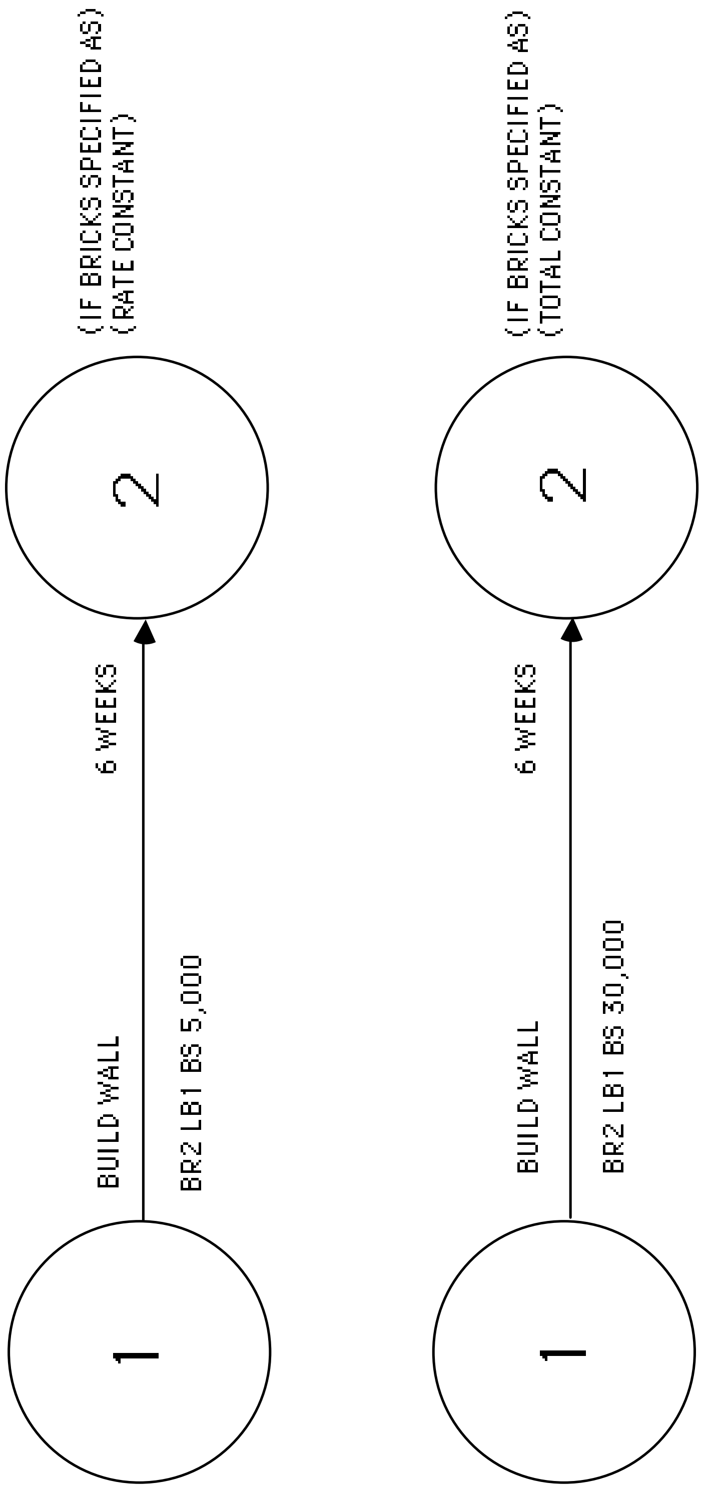

(IF BRICKS SPECIFIED AS)
(RATE CONSTANT)
2
6 WEEKS
BUILD WALL
BR2 LB1 BS 5,000
1
(IF BRICKS SPECIFIED AS)
(TOTAL CONSTANT)
2
6 WEEKS
BUILD WALL
BR2 LB1 BS 30,000
1

FIGURE 1

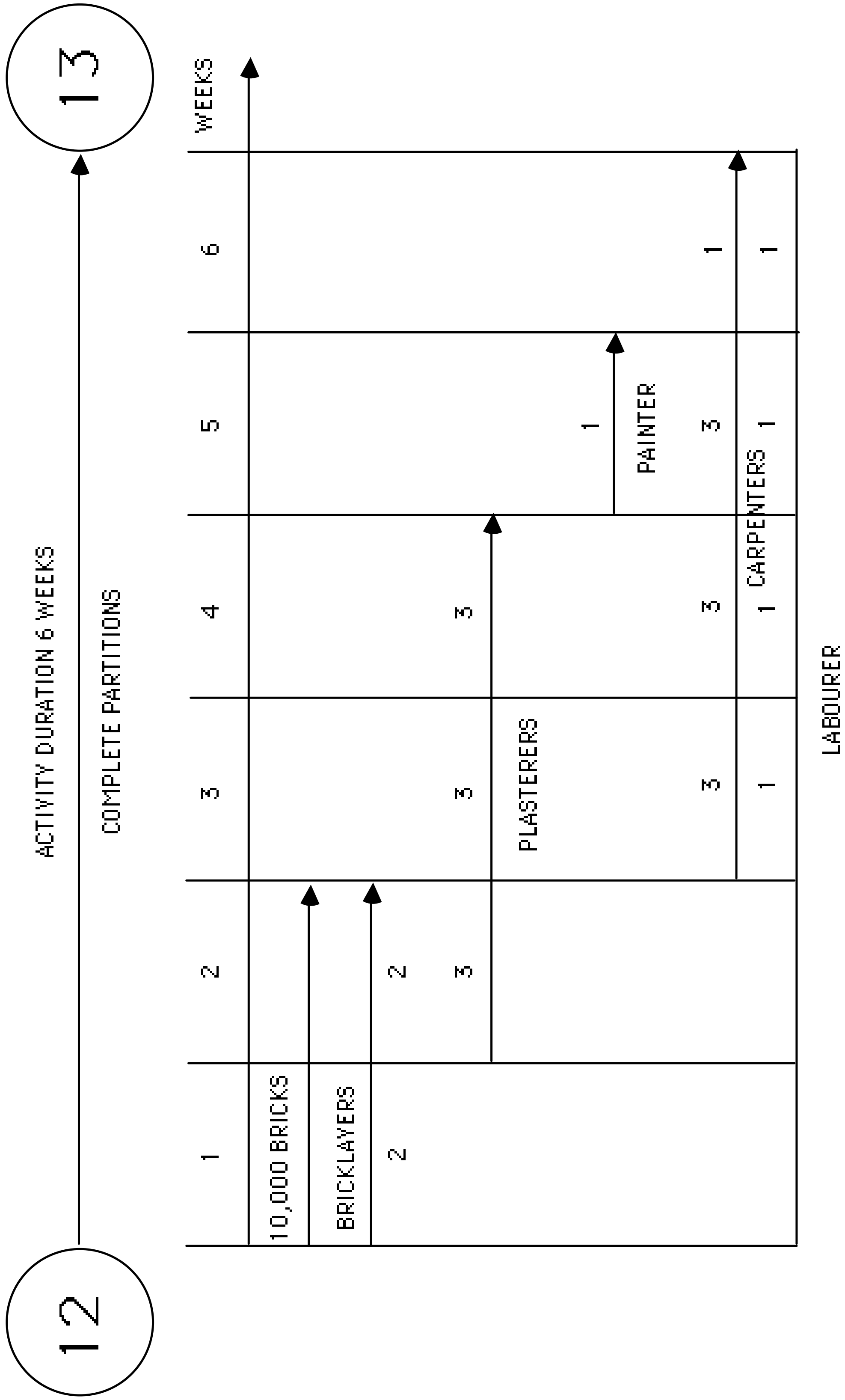

12
13
ACTIVITY DURATION 6 WEEKS
COMPLETE PARTITIONS
WEEKS
1
2
3
4
5
6
10,000 BRICKS
BRICKLAYERS
PLASTERERS
PAINTER
CARPENTERS
LABOURER
2
2
3
3
3
1
3
3
3
3
1
1
1
1
1
1

FIGURE 2

5 Ladder Resource Requirements

Because of the characteristics of progressive feed, resources for the main horizontal activities in a ladder sequence should be considered under the category of complex resources.

To ensure that the Resource Analysis program schedules resources correctly in a ladder complex, it is necessary to observe the following input requirements:-

(1) To designate each of the horizontal rungs of the ladder with the activity type ladder.

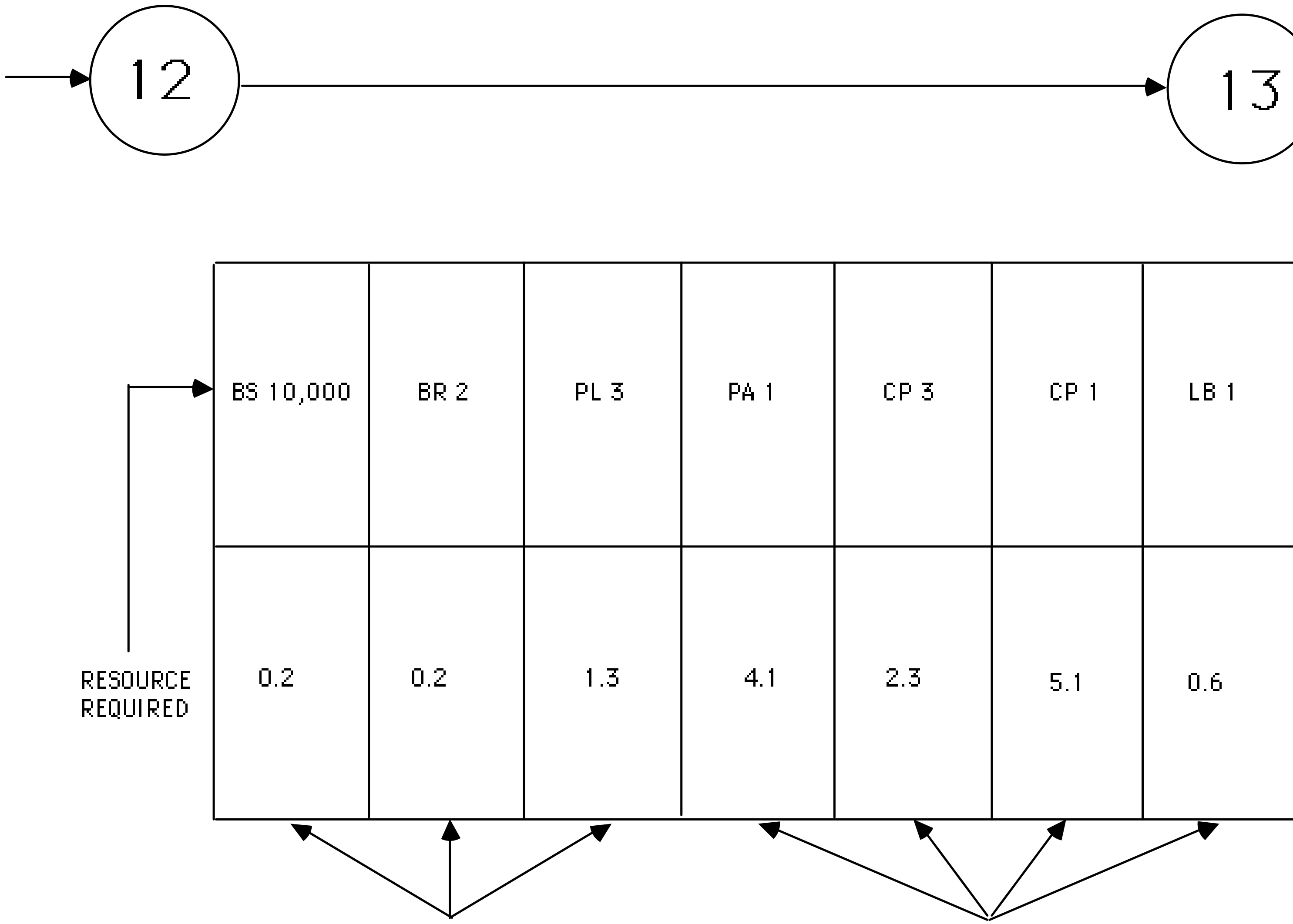

12
13
BS 10,000
BR 2
PL 3
PA 1
CP 3
CP 1
LB 1
0.2
0.2
1.3
4.1
2.3
5.1
0.6
RESOURCE REQUIRED
START OF REQUIREMENT
DURATION OF REQUIREMENT

FIGURE 3

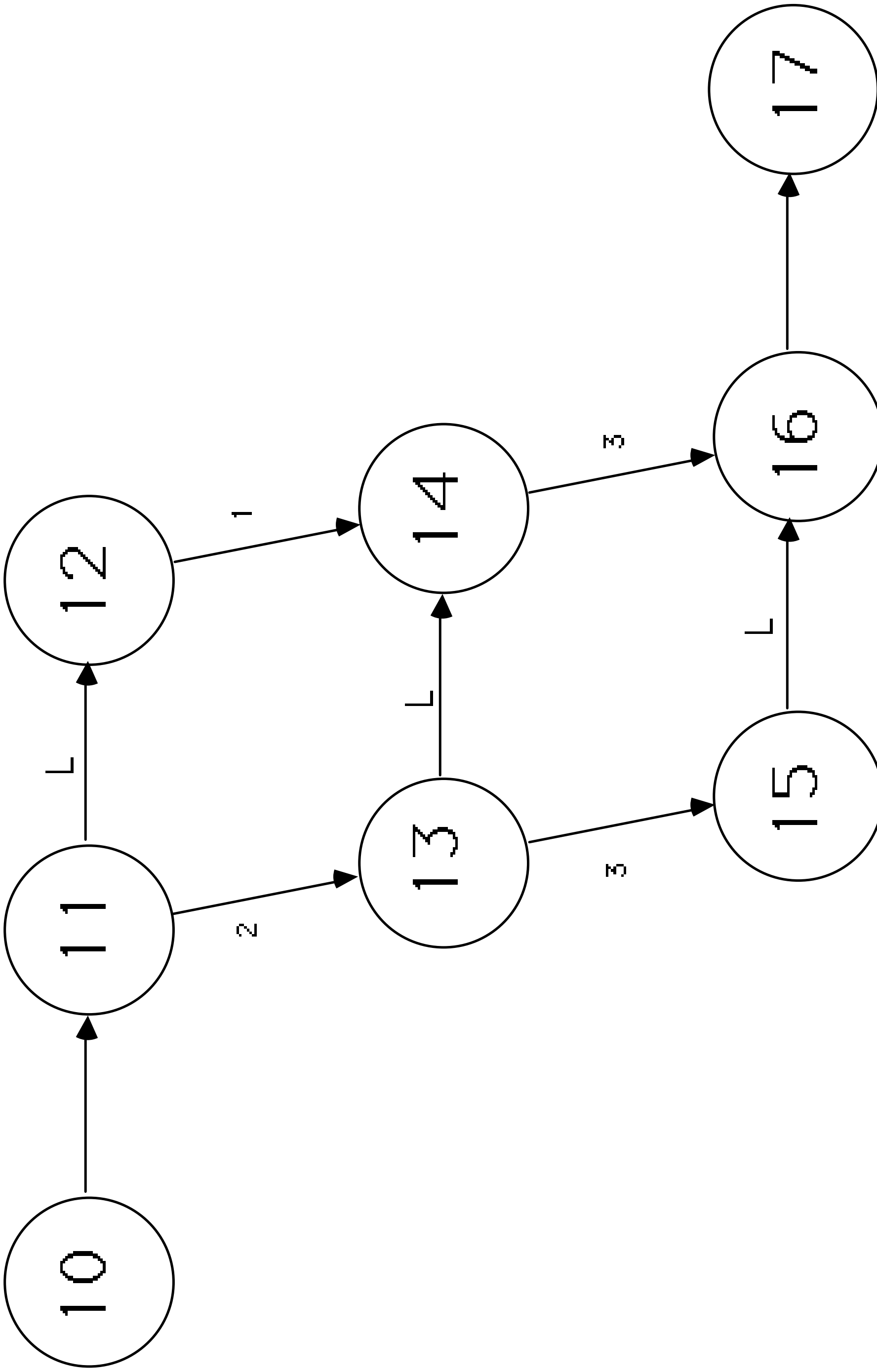


FIGURE 4

6. Resource Categories

When allocating names to resource categories there may be a name up to 12 characters. Up to 250 Resource Categories may be specified.

7. Resource Availabilities

The amount of each resource available to the project may be constant throughout its length or may vary. Up to 20 different changes in level may be used on each resource category. The availability of a resource is specified by naming each period when the level changes and quoting the new level.

Threshold Resources

In certain circumstances it may be desirable to specify 'buffer' resources to be made available if the project(s) cannot be completed on time using normal levels. These additional resources could represent overtime, shift work or subcontracting facilities which could be utilised to minimise time extension to project completion dates. The threshold level may be defined to your precise intentions:

(1) As an amount in addition to the normal availability.
(2) As the total amount including the normal availability.

Both methods will give the same result, but selection of one or the other will depend upon the nature of the problem and management preference.
The program assumes thresholds are input as totals unless differential is specified.

8 Pool Resources

In addition to defining availability of a resource for each time period it is possible to set a pool limit. This is the maximum quantity of a resource which can be carried forward from one time period to the next.

Usually, resources fall into two broad categories:-

(1) Those with a regular rate of supply but with zero pool-limit, such as men. Manpower, when allocated to a project, is available for the time period specified, but does not accumulate if not used.

(2) Those such as capital, materials, space, which in addition to a supply, can be made available to the project as a pool. The pool could be drawn on by some activities, and possibly replenished by others.

9 Management Impositions

The program allows for some degree of intervention by management to impose certain conditions to be observed during the scheduling process. The purpose of this is to permit some mandatory restraints which are either technically necessary or practically desirable. However, if indiscriminate use is made of these facilities, it will WORSEN rather than improve schedules. So care MUST be taken when exercising these options.

Split and Non-Split Activities

Normally, all activities will be considered splittable, that is, capable of being interrupted during scheduling. In principle, activities will be scheduled continuously throughout the activity duration and will only be interrupted to accommodate other activities of more urgent character which use the same limited resource requirements.

Activities which MUST NOT be split during scheduling have to be specified on input. It is also permissable to specify minimum split conditions by stating the duration length of the split portion.

Consecutive Scheduling of Activities (Tied Activities)

Sometimes for technical or economic reasons it is desirable to ensure that two serial activities are scheduled consecutively, that is, without interruption between them. Let us say for example we have two serial activities (a) Assemble Unit and (b) Test Unit. It may be that during the latter part of assembly and the early part of testing, expensive test equipment is required which is possibly in great demand elsewhere. In this case, consecutive scheduling will ensure the minimum retention period consistent with the activity scheduling run.

Whilst this facility may be used in many areas in the network, not more than TWO consecutive activities may be specified.

CHAPTER 2 - SECTION 11

BASIC INTRODUCTION TO MICRO PLANNER AND NETWORK TECHNIQUES

SUMMARY

There are many advantages to be gained from using the MICRO PLANNER technique. The principle advantages can be summarised as follows:-

1. Reduction in Project Times

   By formalising planning, and making scheduling an automatic operation, complex operations can be more effectively coordinated to give significant reductions in project times.

2. Closer Control of Complex Projects

   The ability of the computer to deal with the mass of data quickly and accurately that is involved in the planning and progressing of a complex project and to produce meaningful management reports leads to closer control of complex projects.

3 More Efficient Use of Resources

   MICRO PLANNER distinguishes between those activities which will have a critical effect on the schedule, and those other activities that are on a path having excess time (float) available. By re-arranging resources of manpower and facilities, the critical path cannot only be shortened, but resources can be fully utilised.

4 More Detailed Planning and Scheduling

   The analytical approach and the discipline imposed in the construction of MICRO PLANNER networks for a project automatically excludes unrealistic thinking and leads to more detailed planning and scheduling.

5 Forecast of Potential Bottlenecks

   The detail.ed planning and scheduling of a project will reveal bottlenecks both real and potential. During the progress of the project, the MICRO PLANNER analysis allows continual detailed watch to be kept upon the effect of any delay which can be immediately highlighted. In many cases the delay of one activity need cause no change in schedule, but if the activity is on the critical path then urgent management action must be taken if delay is to be avoided.

6 Ability to Test Alternative Solutions

Planning simulations can be evaluated to test the effects of a variety of changes in the sequencing of events, or allocation of resources. this, therefore enables an optimum project plan to be produced.

7 Lists of Critical Activities requiring Management Action

Management Action becomes more effective when directed toward trouble areas. Progress of whole projects can turn upon a short list of critical items. Micro Planner printout of critical activities and sub-critical activities show those in order of priority.

8 Emphasis on inter-relationships between Activities.

The concept of MICRO PLANNER network construction, highlights the interdependence and inter-relationship between activities. Thus personnel responsible for control of individual activities, can see their position in relation to he rest of the project, and are better able to understand the timing and relationship of their responsibilities to those of other participants in the project.

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