

THE FOREST

A COMPUTER SIMULATION OF  
THE SPORT OF ORIENTEERING

BY

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# The Forest

## 1. INTRODUCTION

This book contains a description and operating manual for the program "The Forest" which runs on the Sinclair ZX Spectrum (48K). A version is also available for the TRS 80 computer. To participate in the game you will need to have a ruler graduated in millimetres and a geometry protractor, for measuring angles.

The main feature of the program is a real-time simulation of the sport of orienteering, in which the user of the program becomes a competitor. Orienteering has been described as "car rallying on foot". It is essentially a cross-country race across difficult terrain (usually forest) to which has been added the extra dimension of navigational problems, though not cryptic problems of the "treasure hunt" kind.

The program is intended to be useful as a training aid to orienteers as well as being a game in its own right. In particular it can assist with the interpretation of contours for navigation, which is one of the most difficult techniques to master in orienteering. This is assisted in the program by displays showing cross-sections through the terrain, contoured three-dimensional views, or maps of any part of it at any chosen scale, contour interval or orientation. Such displays complement the normal view presented by the program which is of the scene ahead when standing on the ground at some point in the forest, with trees and other objects all around.

When moving through the forest in the program, the size of paces and your bearing both drift slightly as they would in real life. You can therefore practise distance estimation and aiming-off techniques as in a real orienteering event. Furthermore your running speed depends on the type of terrain and on the steepness of hill, so realistic route choices are required between controls. The forest is enormous (effectively limitless) and only a small portion has so far been mapped, so unless you are an intrepid explorer, be warned! The forest contains no linear features other than vegetation boundaries and the edges of towns and lakes (ie. there are no roads, fences, streams, etc.) This

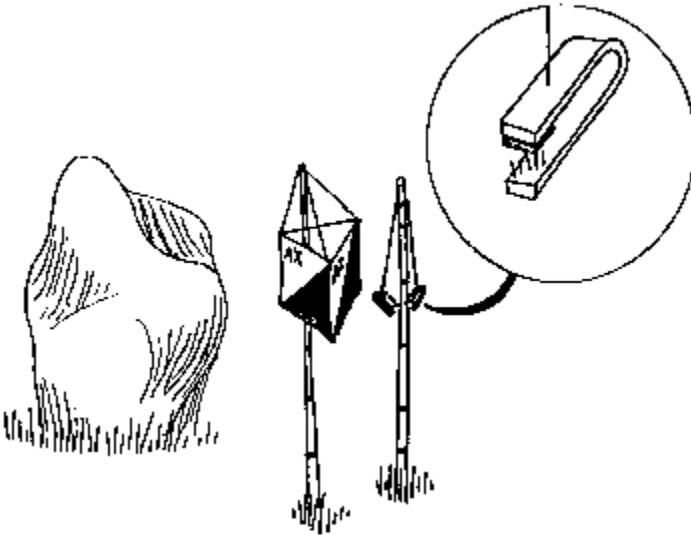
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is to make navigation more difficult for training purposes.

The program can be used to introduce novices to many features of the sport of orienteering and also to train map makers. It is also likely to be of value to Geography teachers, particularly in demonstrating the relationships between maps and the physical features that they represent.

A recent addition to the program is an option to switch to a much more complicated forest with contours more reminiscent of the marvellous terrains in the homelands of orienteering, Scandinavia. A printed map of this is not yet available.

Figure 1 A control point with flag



## 2. ORIENTEERING - THE SPORT

At an orienteering event each competitor is given a detailed printed map of the forest on which is drawn a course to be followed. The course is normally marked in red as a series of numbered circles joined by straight lines. The centre of each circle is a feature printed on the map. This might be a boulder, the corner of a thicket, the junction of two roads, or whatever the course planner has chosen. The corresponding feature on the ground has a red and white control flag next to it, as depicted in Figure 1. The competitor has to visit the marked control points in the numbered sequence but is free to choose any route between controls; it is not necessary and frequently impossible anyway to attempt to follow the straight lines connecting controls on the map. As proof of visiting each control the competitor also carries a "control card" illustrated in Figure 3. This has numbered squares to be marked at the controls. Each control flag bears a simple code of one or two letters or digits which the competitor can check against a description list to ensure that the correct control has been found. An example of a description list is shown in Figure 2. Having found the correct control, the correspondingly numbered box on the control card is punched with a red plastic needle-punch hanging next to the flag. The needles on these punches form various patterns which can easily be checked afterwards.

<b>COURSE BLUE 5.6 KM.</b>	
<b>1 AF</b>	<b>ROOT STOCK</b>
<b>2 AG</b>	<b>FODDER STAND</b>
<b>3 AJ</b>	<b>SE EXTREMITY OF YOUNG TREES</b>
<b>4 BF</b>	<b>SUMMIT</b>
<b>5 BE</b>	<b>PLATFORM</b>
<b>6 BD</b>	<b>KNOLL (1M.)</b>
<b>7 BA</b>	<b>EARTH BANK (OLD QUARRY)</b>
<b>8 AZ</b>	<b>MINE SHAFT IN KNOLL</b>
<b>9 AW</b>	<b>DEPRESSION (2M.) IN KNOLL</b>
<b>10 AV</b>	<b>MINE SHAFT</b>
<b>11 AR</b>	<b>DEPRESSION (1M.)</b>
<b>12 AQ</b>	<b>FENCE</b>
<b>13 BS</b>	<b>JUNCTION OF DITCH AND E.-W. VEG. BOUNDARY</b>
<b>14 BU</b>	<b>PATH BEND</b>
<b>FOLLOW TAPES 200M. TO FINISH</b>	

Figure 2 A description list

Figure 3 A partially completed control card

1	2	3	4	5	6	7	8	9	10	11	12	13		
14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

**YOU MUST HAND THIS CARD TO THE FINISH OFFICIALS**  
 Please complete Card & Counterfoil - Name, Club, Class & Course

CLASS M21B COURSE C CLUB S. R. R. F. C. FINISH 093  
 NAME S. R. R. F. C. START 093 TAKEN - -

Have you got your: whistle, pen, watch, map, description sheet and your compass?

ONLY DETACH THIS COUNTERFOIL AT PRE-START

FINISH 093  
 START 093  
 TAKEN - -

CLASS: M 21 B  
 CLUB: S. R. R. F. C.  
 NAME: S. R. R. F. C.

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The course is a race against time, with competitors usually being started at intervals of at least a minute to prevent them following each other. Other factors which prevent following are that the forested terrain reduces visibility and that different competitive classes (very often this means age groups) have different courses going in quite different directions and crossing each other. Any control flag found may well be on a different course from your own so it is no good just looking for the flags.

The start of the course is marked on the map by a red triangle rather than a circle. The finish is shown by two concentric circles. Neither the start nor the finish need correspond to mapped features. There are usually long tapes laid out to funnel competitors past the finish, so they all pass the time-keeper in the same direction and in single file.

It should be pointed out that although there has been frequent reference to competition in the preceding paragraphs, orienteering is enjoyed by many people purely for the personal challenge of pitting their wits against the map, course-planner and terrain. It is this aspect which the computer program captures best and it is hoped that it will encourage newcomers to go and try the real thing.

### 3. STARTING THE PROGRAM

The program is supplied on a tape cassette in the standard format for the ZX Spectrum. It consists of two program files which must first be loaded into memory. The first is a BASIC program called "forest" which automatically runs when loaded and loads the second file. To load and run The Forest you need to do the following:

```
LOAD "FOREST" (start the tape - NOTE USE CAPITALS
              (stop the tape only when told to do so
              (by the program
```

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The program takes a few seconds to get started. While it is setting up the "course" it displays a title page. If you press any key the screen will soon change to show the scene at the start of the course. Race time is immediately running against you and you should start moving as soon as possible. Race time runs at exactly the same rate as real time, being read from the Spectrum's internal clock. You can see the elapsed race time by using the T command which will be described later.

The map with the course marked on it is the book jacket within the outer cellophane cover of this folder. Remove it carefully. The remaining sections of the book describe how to use the program to navigate around the course.

#### 4. THE DISPLAYED SCENE

Figure 4 is an example of a scene which might be displayed by the program. This shows a number of different things which are described in more detail below.



Figure 4 A scene displayed by the program

#### Terrain Symbols

Ten terrain symbols can be placed in a horizon six metres ahead of you. For brevity we will refer to a terrain symbol as a tree in the rest of this guide but it can take any of the following forms:

A tall tree, often with only the trunk visible because the leaves are off the top of the screen, represents mature wood through which you could easily run. This terrain will be referred to as runnable wood, or just "run". On an orienteering map such areas are shown in white.

A short fir tree represents thicket. Young trees like this are common in real forests and because their branches interlock they

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can be very difficult to get through. The program takes account of this and it is often wiser to skirt round such thickets. On an orienteering map thickets are conventionally green.

A short tufted symbol represents tussocky moorland or heather. This is also slower to move through than other types of terrain. Moorland (the more general orienteering term is "rough open") is printed in ochre or orange on orienteering maps.

A plain bar with no other symbol on it represents open grassland, the fastest terrain to run across. Such open ground is represented in bright yellow on orienteering maps.

A house symbolises a settlement of any size, referred to in the program as a town. No orienteering features appear in the towns and there are consequently no control flags there. Towns do not often appear on real orienteering maps but the general symbol for built-up areas is diagonal black and white line shading.

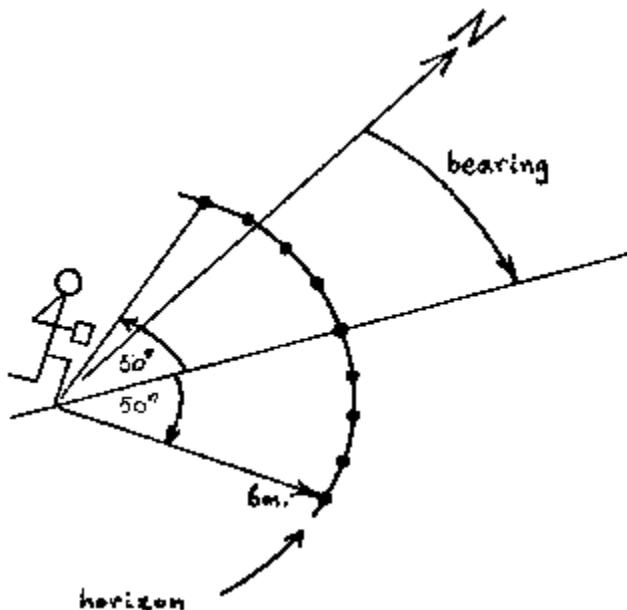
A flecked horizontal bar portrays the surface of a lake. The program does not allow you to run through lakes; forward motion stops with a warning message at the top of the screen. You could wade across any lake by moving one pace at a time (i.e. by pressing a key for every step) but this would be very slow. There are of course no controls in lakes. Lakes are printed in blue on orienteering maps.

The symbols are designed to be displayed in fairly natural colours on a colour television set while also having adequate contrast to be seen clearly on a monochrome set, though the brightness control may need to be increased for the latter.

Each "tree" is positioned naturally enough, with its base showing where the ground would be six metres away from you in its direction. Their relative vertical positions therefore show how the ground undulates ahead of you. The central two trees are standing on the ground straight in front of you. All trees are spaced at intervals of 11.25 degrees. This means that a 100 degree sector of the six metre horizon is visible 50 degrees to

each side. When you turn by using single keys (see later) the scene shifts by the interval between trees; i.e. 11.25 degrees. It therefore requires eight such turns to turn through 90 degrees (there are more direct and precise methods of turning, using the compass which will be described later). Figure 6 shows the relationship between the horizon and you, the observer, standing on the ground.

Figure 6 The observer and the horizon



Level Marker

This takes the form of a small (character-sized) flashing block, always in the same position in the centre of the screen. It shows where the base of the tree straight ahead would be if the ground were exactly level. This enables you to see whether the ground directly ahead slopes up or down and from that the relative positions of the other trees show all the details of the visible ground's height and slopes.

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### Description

A one-word description of the type of terrain where you are currently standing appears in the lower left corner of the screen. This word is one of the following, which describe the terrain types in the same order as at the beginning of this section.

RUN THICK MOOR GRASS TOWN LAKE

### Feature

If a ground feature is visible of the kind that might be used for a control, then a description of it appears at the bottom of the screen, to the right. These "point" features become visible in this way if you are within about 5 metres (approximately 5 paces) of them. You do not have to turn to see them; as long as you are close enough they are announced on the screen (the orienteer's ideal!). If you are more than 5 metres but still within about 10 metres of a feature which has a control flag then the flag appears in a fragmented form between the trees in the general direction of the feature. You will see this as a set of white character-sized blocks on the ground. In this case turning around will affect the visibility of the flag and you can turn to run more directly towards the control. The control will then appear in the foreground as you get within 5 metres of it.

The following features can occur. Brief descriptions are given here because the names used are orienteering terms, as they would appear in the description lists for controls, and their definitions are sometimes peculiar to orienteering. The conventional symbols used on printed orienteering maps are also described.

Boulder	A sizeable single stone lying on the ground. Usually at least 0.5 metres minimum dimension. Symbol: black dot.
Building	Self explanatory. Symbol: solid black rectangle, or for larger buildings, a silhouette.

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Depression	A hollow which is too small to be shown on the map as a contour ring. At least 1 metre deep. Symbol: a brown V.
Knoll	A hill too small to be shown on the map as a contour ring. Symbol: brown dot.
Mine Shaft	A vertical sided rocky-walled depression, usually the blocked remains of an old mine-shaft, so it has a floor. Symbol: Black V.
Niche	A depression in the side of a hill, such that the exit on one side does not slope upwards. Symbol: Brown C, oriented with its mouth towards the level exit.
Pond	A water-filled depression. Symbol: blue V.
Rock outcrop	A very small cliff or rock step, at least 1 metre high. Symbol: black (like a Greek pi), oriented so that the top bar shows the line of the cliff and the two tags point down the step.
Root Stock	The upturned root of a fallen tree, typically 1-2 metres high. Symbol: black X.
Ruin	Ruined building. Symbol: four black dots in a small square formation.
Sheep Fold	A ring of wall, too small to be drawn to scale on the map. Symbol: black circle.
Water Tank	Self explanatory. Symbol: square blue outline.

If the ground feature has a control flag by it, then a flag symbol is shown in the bottom centre of the screen. If you are not moving forwards, then you will see the flag's two letter code painted on it.

Other text can appear at the top of the screen from time to time to give you information or to ask you for something if you have issued a command to the program. Some commands cause the normal scene described above to vanish temporarily; for example, to display the menu or a map.

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### 5. SIMPLE COMMANDS

You communicate with the program by pressing single keys on the keyboard. The following is a description of the effects of each active key. When you have read and understood the description you may like to use Figure 7 as a quick guide to which keys are appropriate at any point in the program. Note that the arrowed keys are the normal ones marked on the Spectrum; i.e. those numbered 5 to 8, but they are used unshifted, to make them easier. The other commands listed here require the CAPS SHIFT key to be used, however, to prevent unintentional use.

#### Up Arrow

This starts you moving forward and motion continues until you press the space bar. On each pace forward the scene is re-displayed to show the view from your new position. One pace is nominally one metre, but it varies randomly within +/- 10%. Each pace forward also causes your bearing to drift by a random amount of up to 1.5 degrees either way. During forward motion only the left and right arrows can be used without stopping the motion; other commands may be used but they will first cause you to stop.

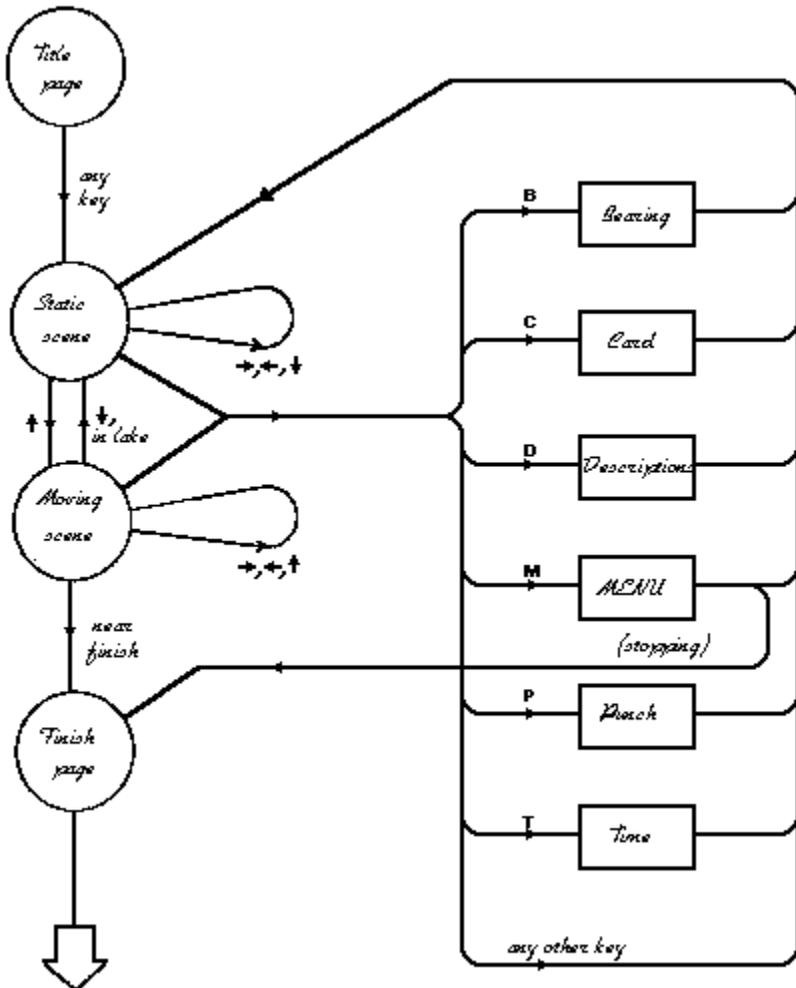
#### Right Arrow

Turns you 11.25 degrees to the right (that is, one tree space or 1/8 quadrant). The scene slides to the left as you turn. This turn can be done while you are moving forward, in which case it takes the place of one forward pace (note this in case you want to count paces to estimate distance travelled).

#### Left Arrow

Turns you 11.25 degrees to the left and the scene correspondingly slides to the right. In all other respects the action is the same as for a right turn above.

Figure 7 N.B. Arrow keys are unshifted (lower case)  
Letter keys are upper case (use CAPS SHIFT)



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### Down Arrow

This causes you to turn right around through 180 degrees to face back the way that you have come. If you were moving forward, this command stops you.

### Any Non-Arrowed Key

Stops you moving forward. You may need to hold the key down for a moment before motion stops and the scene becomes static.

### B (for Bearing)

Looks at the compass. Displays your present bearing (in degrees clockwise from North) and asks for a new bearing to be set. If you then type in any number in the range 0 to 360 (followed by ENTER) you are turned round as necessary and the scene on display is revised to show the new view. If you do not wish to alter the present bearing, just press ENTER instead of typing a number. Note that your bearing will drift when you move forward, by up to 1.5 degrees on each pace. It can even change slightly whilst you are standing still (hopping from one foot to another perhaps). Remember also that you cannot read a real orienteering compass to better than a couple of degrees, especially when moving.

### C (for Control Card)

Clears the screen and displays the control card, complete with the codes of any controls which have been punched. Pressing any key returns you to the forest scene.

### D (for Description List)

Displays the description list for your course. This gives the number code and description of each control you have to visit. Pressing any key returns you to the normal forest scenes.

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### M (for Menu)

Clears the screen and displays a menu of numbered options. These enable you to find your exact position, draw maps, cross-section, or three-dimensional views of any part of the forest, or to give up the course. Most of these are penalised commands, because you would not be able to do such things in real orienteering. The menu options are described in more detail in subsequent sections.

### P (for Punch)

If a control flag is visible this command will put its code in a square of the control card. The program first asks you for the number of the square which is to be marked. This should be the number of the control in sequence on the course. You must make sure that you have found the correct control before punching, by using the D command and by looking at the code on the flag, for which you must first stop moving. The program does not prevent you from punching an incorrect square. You can examine the card before and after punching by using the C command.

### T (for Time)

Looks at your watch to display the elapsed race time.

## 6. FINISHING THE COURSE

To complete the course it is only necessary to move within about five metres of the finish point marked on the map (the centre of the two concentric circles). You may approach the finish from any direction. The program detects when you are close enough to the finish. It then clears the screen, reports any codes which are wrong or missing from your control card, and shows the elapsed race time, in hours, minutes and seconds. It also shows the number of times that you cheated by using the penalised options on the menu. The program then stops, but you may run it again, if you wish, by entering the BASIC command: GOTO 5

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### 7. NAVIGATIONAL TECHNIQUES

Do not under-estimate the difficulty of navigating through The Forest, even if you think that you are a good map reader. The following factors make navigation particularly difficult:

- There are few "handrails" to follow; there are no roads, paths or streams. You can, however, follow vegetation boundaries and the edges of towns and lakes.
- The direction of motion, your bearing, drifts as you move forward.
- The length of your pace varies, so counting your paces only gives an estimate of the distance travelled.

The first of these factors is deliberate, to make navigation less easy. The other two reflect the real difficulties encountered in the sport of orienteering. There are techniques for minimising these difficulties and some simple rules will now be given.

Always count your paces as you move; i.e. the number of times the scene is redisplayed. The distance travelled is then, within +/- 10%, the same number of metres on the ground, or 1/10 millimetres (mm) on the 1:10,000 scale printed map:

1mm on map = 10 metres on ground = 10 paces.

Use the B command regularly to confirm that you have not drifted too far from the direction you have set with the compass, and to correct it if you have.

Always stop moving while you check your position on the map. When you gain experience, you will be able to keep relating the displayed scene to the map as you move and then you will need to stop less often. To begin with you should err on the side of caution.

Because bearings drift as you move, you must not expect to be able to hit a point feature by aiming directly at it from more than about 50 metres away (5mm on the map). Instead you should

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aim for a larger feature, perhaps a town or a lake. When you reach that, find a corner from which to aim for the point feature or for another one to use as a "stepping stone". If the initial large feature (or "collecting feature" in orienteering terms) is to one side of the small feature you are seeking, then you must deliberately aim towards that side so you can be sure of finding the larger feature. This technique is called "aiming off". As an example, consider the first leg of the set course in the program. One way of finding the first control is to set a bearing of 50 degrees before moving off. This points you towards the lake 140 m north-east from the start. Count paces as you go, and stop to check your bearing at least every 40 m; if it has changed by more than three or four degrees, then correct it before continuing. You should see the lake after 150 paces at most. Turn to the right as you approach, to look along the shore with the lake on the left and tall trees on the right. Stop again to take a bearing which will either confirm that you are on the southern edge of the lake (bearing about 90 degrees) or, if you drifted left, the western edge (bearing about 180 degrees). Following the southern edge of the lake for anything up to 60 paces you will suddenly see the lake disappearing off the left-hand edge of the screen and the ground ahead beginning to rise. This means that you are at the south-east corner of the lake. Here you should stop again to set the direct bearing of 93 degrees to run about 40 paces uphill to the depression. You may see a niche on the way, confirming your course, but do not worry if you miss that. If you miss the target depression, you are almost certain to meet the town behind it, so you cannot go far wrong. Subsequent controls do not have such safety nets behind them, however.

Suppose you do get lost - what then? The golden rule is to stop moving. Do not be tempted to explore the vicinity at random - you would only move further from the last place where you knew your position. Having stopped, carefully review the moves you have made since the last time you were sure of your position. Then take a bearing, so you know which direction you have come from. Next, examine your surroundings, without moving from the spot, and try to relate them to the map. This will rule out

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many locations. Study the slope of the ground ahead and to either side; whether it is rising or falling and its relative steepness. Check the type of terrain that you are standing in and turn round slowly to see the terrain types on the 6m horizon. If a point feature is visible, its description may immediately narrow the possibilities down considerably. If, on turning around, you see a control flag through the trees then you could move towards it and stop there to see what kind of feature it is on. Doing all these things will probably provide quite a short list of possible locations and you will need to start moving to confirm one of them. Try to find a large feature on the map which is near the suspected location. Set a bearing and move towards it, counting paces. Stop very frequently to check your bearing so you could retrace your steps if necessary. Do not move too far at a time until you know where you are once again. If you are really stuck the program provides a way out, which is not available in real orienteering: use Option 1 on the main menu (command M for Menu), to obtain your coordinates, x and y. Subtract 1000 from x, divide by 10 and measure that number of mm eastwards from the left side of the printed map. Subtract 1700 from y, divide by 10 and measure that number of mm northwards from the bottom edge of the map. The intersection of these two measurements gives your position on the map. If you resort to this method, however, the program will later expose you as a cheat!

When you become more proficient, the contours can be used for navigation across featureless areas, instead of following boundaries or aiming off. Although it is abstract and invisible you can follow a contour by steering to keep the level marker in the displayed scene as close as possible to the base of the central tree symbol.

Of all these rules, the most important is to stop moving and think whenever you are in doubt, despite the fact that race time is running against you. It is surprising how quickly you can move away from a known position when you are not concentrating.

Finally, it must be borne in mind that, like computer software,

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no map is ever perfect. The one supplied with this program is no exception. While every effort has been made to ensure accuracy, it is possible to find features which are not on the map. The immediate surroundings of each control on the set course have been checked particularly carefully, however. If you use the Course Planners menu you should also explore the neighbourhood of each control carefully first, as would be done by the planners and controllers of real orienteering events.

### 8. THE MENU

When the forest scene is visible, the M command causes the screen to be cleared and a list of numbered options is displayed:

```
THE FOREST : MAIN MENU
0) Return to scene (no penalty)
1) Get coordinates
2) Map terrain types
3) Map contours
4) Scan for point features
5) Draw cross-section
6) Draw 3D view
7) Give up (stop)
8) Go to more complex forest
9) Alter the set course
```

Which?

```
NB: 1 to 6 are not possible in
real orienteering, so they are
counted as cheating and will be
reported at the finish.
After an option any key returns
to this menu.
```

Most of the options on the menu are not the sort of thing that you could do in real orienteering and therefore the number of times you use them is added up by the program and held against you at the end. Their purpose is instructional, to show the relationship between the map and the ground in various different ways. We will describe them in more detail but there are two general concepts to mention first: coordinates and the means by which the program will prompt for information to define an area to be mapped or drawn.

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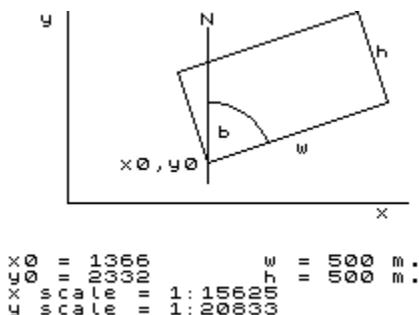
Any position in the forest, such as where you are standing, is represented in the program by Cartesian coordinates,  $x$  and  $y$ , each measured in metres. These are similar to grid references in map terms:  $x$  is the number of metres measured east from some fixed reference point and  $y$  is the number of metres measured north from the same point.  $X$  distances should always have 1000 added to them.  $Y$  distances are measured from the bottom of the map and should have 1700 added to them. Remember that 1mm of map = 10 metres.

When you select any option which will result in a map or view of some portion of the forest you will first be asked to define that portion. The program uses a standard diagram and a series of prompts for the definition, with minor variations for the different types of drawing. The following items have to be entered in response to the prompts.

The coordinates ( $x_0$  and  $y_0$ ) of the bottom left hand corner of the portion of terrain to be plotted. If you wish to draw a map or view around your current position, you should first use Option 1 on the menu to obtain the coordinates of that position.

You then have the option of entering either the width and height (in metres) of the rectangular area to be plotted or the scale of the resulting map. Scale is used in a relative sense here, because different televisions will of course draw the map at different sizes. If you specify a scale of 1:n,000 this really means that the program will plot the terrain for a square grid of points every  $n$  metres on the ground. The most useful aspect of this appears when you draw successive maps of a similar area at various scales and compare them. Whether you specify width and height or scale, all these values will then be displayed on the screen. This will enable you to see the width and height corresponding to a given scale and vice versa. Note that for cross-sections (menu option 5) only the width and  $x$ -direction scale are relevant and a modified diagram is presented by the program to guide you.

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An angle  $b$  defines the orientation of the map. This angle is the bearing (clockwise from North) of the bottom edge of the map. For a conventional upright map  $b$  would be 90 degrees. The ability to specify this angle is particularly useful for the three-dimensional views (menu option 6). Suppose that the  $xy$  coordinates specify the middle of a lake; whatever orientation or angle is chosen for  $b$  that lake will always be at the left-hand bottom corner of the screen. For a 90 degree value of  $b$  north is at the top of the screen; for a 180 degree value of  $b$  north is the left-hand edge of the screen; for a 270 degree value of  $b$  north is at the bottom of the screen; for a 360 or 0 value of  $b$  north is at the right-hand edge of the screen.

For contour maps only (menu option 3) you must also select a contour interval. The program will accept values in the range from 1.25 to 80 metres, but the actual contour interval used will be the nearest value in the following list which is less than or equal to your specified value:

1.25, 2.5, 5, 10, 20, 40, 80

Usually 5 metres is a suitable interval to specify, but it is instructive to try various intervals on successive maps of one area.

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For point-feature scan only (menu option 4) you must specify a step size. The point-feature scan is a means of finding all the point features in any rectangular area. The area has to be defined in the same way as for maps, but when you have done that, the program will take you for a fast ride through the forest in a raster-scan pattern. This first goes north, along the left edge of the rectangle, then turns through 180 degrees and brings you back along an adjacent strip, rather like mowing a lawn. Whenever a point feature is visible, the program pauses to let you see it, its control flag (if any) and the code on its flag. As your coordinates are continually displayed in the top left corner of the screen during such a scan, this provides a means of plotting every feature on a map and listing their details. To continue from a pause press any key. SPACE will return you to the menu but any other key will continue with the raster scan. This process had to be done to prepare the printed map of the forest and to plan the course. Returning to the step size: point features are visible in an 8 metre square. It is therefore sufficient to specify an 8 metres step size if you wish to see every feature in your rectangle (except for a very few which are close to lakes and towns).

The display screen of the Spectrum having only 32 by 24 addressable blocks of colour, does not lend itself to the detailed full-colour cartography usually used for orienteering. In this program no attempt has been made to display full graphical maps. Instead the information has been split into three types for separate display. All the examples in the figures which follow have been taken with the coordinate reference of the start 1366/2332 and specify a square 500 metres by 500 metres with an orientation of 90 degrees.

### Terrain types (menu option 2)

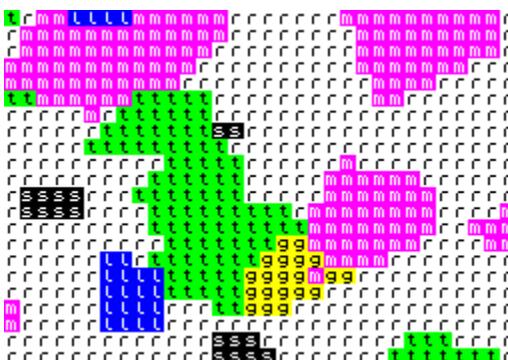
A grid of letters in 24 rows of 32 columns is displayed to represent a component of the map. The letters are simply abbreviations of the type of terrain at each point and they are on coloured squares following the colour conventions of orienteering

## The Forest

maps as far as possible:

L	Lake	blue
S	Settlement (town)	black
T	Thicket	green
R	Runnable wood	white
M	Moor	magenta (there is no ochre)
G	Grass	yellow

Figure 8 Terrain type map



### Contours (menu option 3)

A 24 by 32 grid of letters is again used. This time the letters represent height bands: the higher the ground the later the letter in the alphabet. The assignment of letters to height ranges depends on the contour intervals you have chosen for the map. Colours are also assigned to the height bands to make them easily distinguishable. The Spectrum's eight colours are used in rotation as height increases.

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## The Forest

### Other Software from Phipps Associates

Books The Spectrum Pocket Book \* Toms, T  
Atom Business \* Phipps, J  
The ZX80 Pocket Book Toms, T  
The ZX81 Pocket Book \* Toms, T  
Load and Go with your DragonPhipps J. & Toms, T.

### Cassettes

#### Adventures for the 48K Spectrum

Knight's Quest  
Magic Mountain  
Pharaoh's Tomb  
Greedy Gulch

#### Games for the 48K Spectrum

Black Planet  
Gorgon

#### Games for the 16K Spectrum

Dominoes  
Rabbit Shoot  
Nowotnik Puzzle

#### 16K ZX81

Knight's Quest Adventure  
Adventure Tape no.1 (containing 3 adventures)  
Dominoes  
Nowotnik Puzzle and other diversions

\* above means cassettes for the books also available