

## 2003 Paper 3 Question 8

### Computer Graphics and Image Processing

- (a) Pick *two* of these three colour spaces: Lab, CMYK, HLS. For each of your chosen two colour spaces, explain what each of the dimensions represents and for what uses the colour space is best suited. [6 marks]
- (b) Describe a run-length encoding method for greyscale images. [6 marks]
- (c) The following is a Bezier curve drawing algorithm which includes bounding box clipping. Provide pseudocode for the functions `InBoundingRect` and `DrawUnclippedBezier`.

```
function DrawClippedBezier(float x1, y1, x2, y2, x3, y3, x4, y4)
begin
  if NearlyStraight(x1, y1, x2, y2, x3, y3, x4, y4)
  then DrawClippedLine(x1, y1, x4, y4)
  else begin
    r = InBoundingRect(x1, y1, x2, y2, x3, y3, x4, y4) ;
    if(r==0) then DrawUnclippedBezier(x1, y1, x2, y2, x3, y3, x4, y4);
    if(r==1) then begin
      DrawClippedBezier(x1,y1, (x1+x2)/2,(y1+y2)/2,
        (x1+2*x2+x3)/4,(y1+2*y2+y3)/4,
        (x1+3*x2+3*x3+x4)/8,(y1+3*y2+3*y3+y4)/8);
      DrawClippedBezier((x1+3*x2+3*x3+x4)/8,(y1+3*y2+3*y3+y4)/8,
        (x2+2*x3+x4)/4,(y2+2*y3+y4)/4,(x3+x4)/2,(y3+y4)/2,x4,y4);
    end ;
    if(r==2) then return ;
  end ;
end;
```

Notes: The bounding rectangle is defined by the four (global) floating point variables `left`, `right`, `top`, and `bottom`. You may assume that we have two line drawing functions available `DrawClippedLine` and `DrawUnclippedLine`. The former draws a line having first clipped it to the bounding rectangle, the latter just draws a line without regard for the bounding rectangle (which should therefore only be used if the programmer has assured him- or herself that the line will not extend beyond the bounding rectangle). The two functions `DrawClippedBezier` and `DrawUnclippedBezier` do the same for Bezier curves. The function `NearlyStraight` returns `true` if the Bezier curve lies within half a pixel of a straight line from its first to its last point along its entire length, otherwise it returns `false`.

[8 marks]