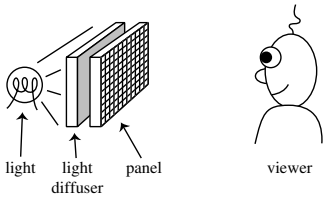
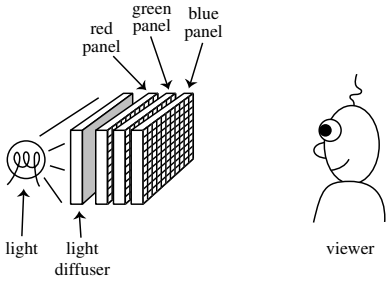
1998 Paper 13 Question 4

Computer Graphics and Image Processing

An inventor has recently developed a new display device: it is a transparent panel with a rectangular array of square pixels. The panel is tinted with a special ink which allows each pixel to range from totally transparent to transmitting only the colour of the ink. Each pixel has an 8-bit value. For example, if the ink is blue then a pixel value of 0 would be totally transparent, 255 totally blue (only blue light transmitted) and 100 a light blue.



The inventor has recently found that he can make the special ink in *any* colour he likes, but that each panel can be tinted with only one of these colours. He proposes to use three inks in three panels to make a 24-bit colour display: a red-tinted panel, a green-tinted panel and a blue-tinted panel will be stacked up to make a full-colour display (see picture). A value of $(0, 0, 0)$ will thus be white (transparent), $(255, 0, 0)$ red and $(255, 255, 255)$ black.



Explain why this will not work. [4 marks]

Modify the three-panel design so that it will work. [3 marks]

In common with other 24-bit "full-colour" displays (for example CRT, LCD), your display *cannot* display *every* colour which a human can perceive. Why not? [3 marks]

In image compression we utilise three different mechanisms to compress pixel data:

(a) mapping the pixel values to some other set of values

(b) quantising those values

(c) symbol encoding the resulting values

Explain each mechanism, why it helps us to compress the image, and whether (giving reasons) the resulting image noticeably differs. [10 marks]