

Mechanical Engineering

Graphics

1. Explain with a diagram how a shadow mask cathode ray tube works. [12 marks]
2. What might be the point of extending the scheme to accommodate five electron guns?
[8 marks]
3. Describe the method of Douglas & Pucker for approximating one line chain by another to within some tolerance. Are there any special cases? [20 marks]
4. Discuss sampling artifacts and their effect on image quality on a raster display. [10 marks]
5. What can be done to reduce or eliminate them? [10 marks]
6. Discuss transformations applied to 3D wireframe objects. [12 marks]
7. Discuss the use of homogeneous coordinate representations
 - a. for presenting concepts. [4 marks]
 - b. within programs. [4 marks]
8. Explain the purpose and operation of the A-buffer in rendering a sequence of images into a frame store. [12 marks]
9. Exhibit an example that shows an advantage over the use of a Z-buffer. [8 marks]
10. Why are matrix representations used to describe point transformations in computer graphics?
[6 marks]
11. Describe how to represent three different 2D transformations as matrices. [6 marks]
12. Explain how to derive a sequence of transformations to achieve the overall effect of performing a 2D rotation about an arbitrary point. [8 marks]
13. In ray tracing a large computational cost is associated with determining ray-object intersections. Explain how the use of bounding volumes and space subdivision methods may reduce this cost. [20 marks]
14. Describe a quad-tree encoding method for greyscale images. [6 marks]
15. Given the following greyscale image, draw a diagram showing how it would be encoded using your method from the previous part

33	39	43	72
34	54	64	81
42	54	71	83
60	64	77	89

[4 marks]

16. An image processing package allows the user to design 3 x 3 convolution filters. Design 3 x 3 filters to perform the following tasks:

a. blurring [2 marks]

b. edge detection of vertical edges [2 marks]

17. Choose one of the two filters (a) or (b) from the previous part. Explain how it works, using the following image as an example (you may round off any calculated values to the nearest integer).

100	100	100	0	0	0
100	100	100	0	0	0
100	100	100	0	0	0
100	100	100	100	100	100
100	100	100	100	100	100
100	100	100	100	100	100

[6 marks]

18. Consider the control of detail in a curve represented as a sequence of straight-line segments.

a. Describe Douglas and Peucker's algorithm for removing superfluous points.

[10 marks]

b. Describe how Overhauser interpolation can be used to introduce additional points.

[10 marks]