
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

MSG 387 – Computer Graphics
[Grafik Komputer]

Duration : 3 hours
[Masa : 3 jam]

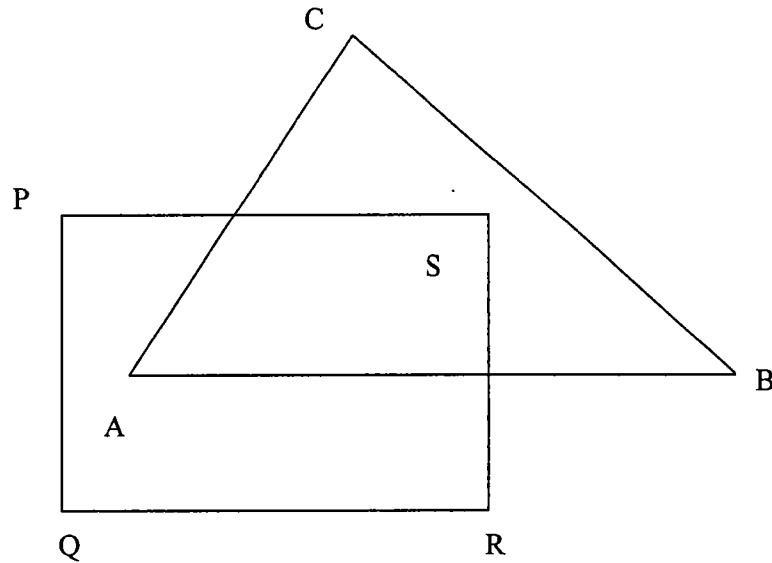
Please check that this examination paper consists of FIVE pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **all four** [4] questions.

[Arahan: Jawab **semua empat** [4] soalan.]

1. (a) Given



PQRS is a clipping window and ABC is a triangle. Describe a process of cutting the triangle ABC against the clipping window PQRS using Sutherland-Hodgman polygon clipping algorithm.

[60 marks]

(b) Discuss the following terms:

- (i) Bitmap.
- (ii) Pixmap.
- (iii) Scan line.
- (iv) Pixel mask.
- (v) Graphics output primitives.

[40 marks]

2. (a) Describe a two dimensional viewing pipeline.

[10 marks]

(b) A line segment and a triangle are displayed in a display window of size 600 pixels width and 450 pixels height.

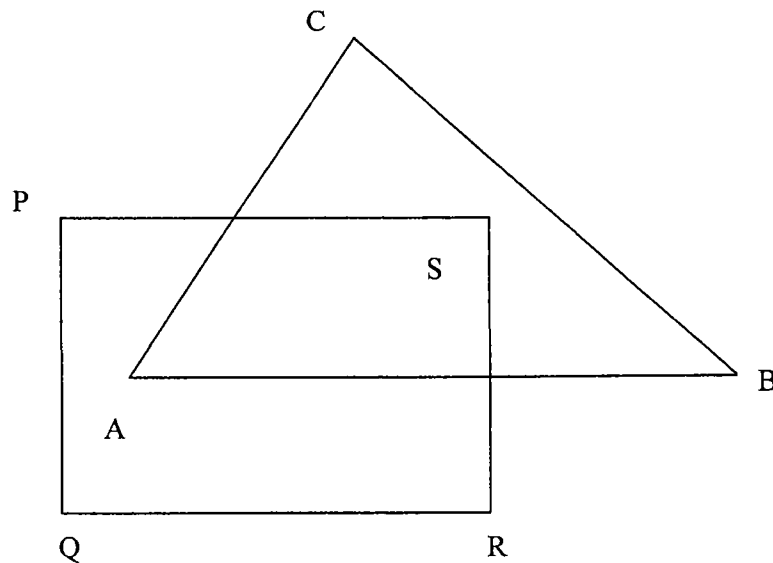
If in the world coordinate, the origin of the line segment will be at $(-8, -2)$ and the origin of the triangle is at $(7, 1)$ and in the modeling coordinate, the coordinates of the line segment endpoints are $(0, 0)$ and $(6.0, 12.0)$ and the coordinates of the triangle vertices are $(0, 0)$, $(10, 3)$ and $(8, 14)$, then find the coordinates of the line segment endpoints and the triangle in the display window in term of pixels.

[60 marks]

(c) Describe all the steps taken in designing an animation. Explain briefly each of the steps.

[30 marks]

1. (a) Diberi



PQRS ialah suatu tetingkap guntingan dan ABC ialah sebuah segitiga. Perihalkan proses menggunting segitiga ABC terhadap tetingkap guntingan PQRS menggunakan algoritma guntingan poligon Sutherland – Hodgman.

[60 markah]

(b) Bincangkan istilah-istilah berikut:

- (i) Bitmap.
- (ii) Pixmap.
- (iii) Garis imbas.
- (iv) Topeng piksel.
- (v) Primitif output grafik.

[(40 markah)]

2. (a) Perihalkan " pipeline " pemandangan dua dimensi.

[10 markah]

(b) Suatu tembereng garis dan sebuah segitiga dipaparkan dalam tetingkap paparan yang bersaiz 600 piksel lebar dan 450 piksel tinggi.

Jika dalam koordinat dunia, asalan tembereng garis di (-8, -2) dan asalan segitiga di (7, 1) dan dalam koordinat model, koordinat hujung-hujung tembereng garis ialah (0, 0) dan (6.0, 12.0) dan koordinat bucu-bucu segitiga ialah (0, 0), (10, 3) dan (8, 14), maka cari koordinat tembereng garis dan segitiga dalam tetingkap paparan dalam sebutan piksel.

[60 markah]

(c) Perihalkan semua langkah-langkah yang diambil dalam mereka bentuk suatu animasi. Jelaskan dengan ringkas setiap langkah tersebut.

[30 markah]

3. (a) Discuss and classify the logical interactive input devices.

[20 marks]

- (b) Describe the Basic Positioning Method in an interactive picture construction.

(20 marks)

- (c) A triangle with vertices at A(4, 0), B(7, 1) and C(1,5) is rotated 45° in counter clockwise direction about (7, 1), then is reduced 50% horizontally and enlarge 100% vertically about (7, 1) and finally is reflected about y axis. Find the final coordinates of the vertices of the triangle.

[60 marks]

4. (a) A clipping window is defined by (-1, -1) and (1, 1). Clip the following line segments against the clipping window using the parametric representation method:

- (i) Line AB where A(-0.2, 0) and B(0.2, 0.8).
- (ii) Line CD where C(-0.4, -0.8) and D(2.0, -1.9).
- (iii) Line EF where E(-1.5, 0) and F(0, 1.1).

[50 marks]

- (b) If the center of projection is at (0, 0, -d) and the projection plane is on the xy plane, then derive the following perspective transformation matrix

$$M_{\text{pers}} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{d} & 1 \end{pmatrix}.$$

[50 marks]

3. (a) Bincangkan dan kelaskan peranti input logik saling aktif.

[20 markah]

- (b) Perihalkan Kaedah "Basic Positioning" dalam suatu pembinaan gambar saling aktif.

[20 markah]

- (c) Sebuah segitiga dengan bucu-bucu di $A(4, 0)$, $B(7, 1)$ dan $C(1, 5)$ diputar 45° dalam arah lawan jam terhadap $(7, 1)$, kemudian dkecilkan 50% secara mengufuk dan diperbesarkan 100% secara menegak terhadap $(7, 1)$ dan akhirnya dipantulkan terhadap paksi y. Cari koordinat terakhir bagi bucu-bucu segitiga.

[60 markah]

4. (a) Suatu tetingkap guntingan ditakrifkan oleh $(-1, -1)$ dan $(1, 1)$. Gunting tembereng-tembereng garis berikut terhadap tetingkap guntingan menggunakan kaedah perwakilan berparameter:
- (i) Garis AB di mana $A(-0.2, 0)$ dan $B(0.2, 0.8)$.
 - (ii) Garis CD di mana $C(-0.4, -0.8)$ dan $D(2.0, -1.9)$.
 - (iii) Garis EF di mana $E(-1.5, 0)$ dan $F(0, 1.1)$.

[50 markah]

- (b) Jika pusat unjuran berada di $(0, 0, -d)$ dan satah unjuran berada di atas satah xy, maka dapatkan matriks penjelmaan perspektif berikut

$$M_{pers} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{d} & 1 \end{pmatrix}.$$

[50 markah]