

Computer Graphics

1. The point (4, 1) undergoes the following 3 transformations successively.
 - I. Reflection about the line $y = x$
 - II. Translation through a distance of 2 units along the positive x-axis
 - III. Rotation through an angle of $\pi/4$ about the origin in the counter clockwise direction.
 The final position of the point will be

(a) $(-1/\sqrt{2}, 7/\sqrt{2})$	(b) (1, 4)
(c) $(3/\sqrt{2}, -5/\sqrt{2})$	(d) $(3/\sqrt{2}, 5/\sqrt{2})$
2. Let the maximum number of pixels in a line be M . The number of subdivisions at most necessary using the mid-point subdivision method of clipping is

(a) $N = \log_2 M$	(b) $N = 2^M$
(c) $n = 2 M$	(d) none of the above
3. Find the incorrect statement(s).
 - (a) A perspective projection produces realistic views.
 - (b) A parallel projection preserves realistic dimensions.
 - (c) A perspective projection preserves realistic dimensions.
 - (d) A parallel projection gives realistic representation of 3-D objects.
- *4. The people of the planet Mars designed a scale for measuring the temperature in which water freezes at 100 units and boils at 250 units. The people of Jupiter designed a scale in which water freezes at 75 units and boils at 300 units. A temperature of 200 units in Mars will measure _____ in Jupiter.

(a) 300	(b) 225	(c) 250	(d) 175
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- *5. The two scales coincide at

(a) 130	(b) 165	(c) 150	(d) 170
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6. Oblique projection with an angle of 45° to the horizontal plane is called as
 (a) cabinet projection (b) isometric projection
 (c) cavalier projection (d) none of the above
- *7. Which of the following curves are symmetric about the line $x = y$?
 (a) $1 + x + y = 0$ (b) $y = |x|$ (c) $y = x^3$ (d) $|x| + |y| = 9$
8. Choose the correct statement(s).
 (a) Random-scan monitors draw a picture one line at a time.
 (b) The components line of a random-scan picture must be refreshed in a particular order.
 (c) Raster-scan monitors draw a picture one line at a time.
 (d) Random-scan method is well suited for displaying shading and colour areas.
9. The perspective anomaly in which the object behind the centre of projection is projected upside down and backward onto the viewplane is called as
 (a) perspective foreshortening (b) vanishing view
 (c) view confusion (d) topological distortion
10. Which statement about beam penetration method for producing colour display is/are true?
 (a) It is used with raster-scan monitors.
 (b) It is used with random-scan monitors.
 (c) By using beam penetration method a wide range of colours can be obtained.
 (d) It uses three electron guns, one each for green, blue and red colours.
- *11. $x = at^2$; $y = 2at$, is the parametric equation of a
 (a) circle (b) rectangular hyperbola
 (c) parabola (d) ellipse
- *12. A line connecting the points (1, 1) and (5, 3) is to be drawn, using the DDA algorithm. Find the value of x and y increments.
 (a) x -increment = 1 ; y -increment = 1 (b) x -increment = 0.5; y -increment = 1
 (c) x -increment = 1 ; y -increment = 0.5 (d) none of the above
- *13. The entire graph of the function $f(x) = x^2 + kx - x + 9$ is strictly above the x -axis if and only if
 (a) $-3 < k < 5$ (b) $-3 < k < 2$ (c) $-3 < k < 7$ (d) $-5 < k < 7$
14. The phenomenon of having a continuous glow of a beam on the screen even after it is removed is called as
 (a) fluorescence (b) persistence (c) phosphorescence (d) incandescence
- *15. Perform window to viewport transformation for the point (20, 15). Assume that (X_{wmin}, Y_{wmin}) is (0, 0); (X_{wmax}, Y_{wmax}) is (100, 100); (X_{vmin}, Y_{vmin}) is (5, 5); (X_{vmax}, Y_{vmax}) is (20, 20). The value of x and y in viewport is
 (a) $x = 4, y = 4$ (b) $x = 3, y = 3$
 (c) $x = 8, y = 7.25$ (d) $x = 3, y = 4$

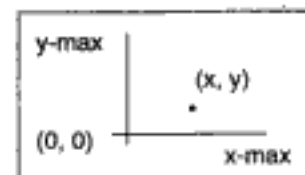


Fig. 10.1

- (c) by copying each row of the block into a column in the new frame buffer location
 (d) none of the above
27. In the clipping algorithm of Cohen & Sutherland using region codes, a line is already clipped if the,
- codes of the end points are the same.
 - logical AND of the end points code is not 0000.
 - logical OR of the end points code is 0000.
 - logical AND of the end points code is 0000.
- *28. Choose the functions that are periodic.
- $f(x) = x - [x]$; where $[x]$ stands for the greatest integer $\leq x$
 - $f(x) = |\cos(x)|$
 - $f(x) = (x) \cos(x)$
 - $f(x) = \sin(1/x)$, if $x \neq 0$; 0 otherwise
29. In Sutherland-Hodgman algorithm for polygon clipping, assume P (present point) lies inside the window and S (previous point) lies outside the window. Then, while processing through that window boundary, we should
- store the intersection point of line PS (S') only
 - store the points P and S'
 - store the point P only
 - store the points S and S'
30. Random-scan monitors are also referred to as
- vector display
 - stroke writing display
 - calligraphic display
 - none of the above
31. The refresh rate below which a picture flickers is
- 25
 - 30
 - 35
 - 60
32. Pixel phasing is a technique for
- shading
 - anti-aliasing
 - hidden line removal
 - none of the above
33. When several types of output devices are available in a graphic installation, it is convenient to use
- bundled attributes
 - unbundled attributes
 - inquiry attributes
 - none of the above
- *34. Which of the following points lies on the same side as the origin, with reference to the line $3x + 7y = 2$?
- (3, 0)
 - (1, 0)
 - (0.5, 0.5)
 - (0.5, 0)
- *35. If $(a, b, c) \times (1, 3, 1) = (2, 1, 6)$, where \times denotes the vector product, then (a, b, c) is given by
- (0, 1, 1)
 - ($k, 0, 1 - k$) for any real k .
 - (-1, 2, -7)
 - there exists no solution

- *36. Which of the following transformations are non-commutative?
 (a) Linear followed by scaling (b) Linear followed by rotation
 (c) Scaling followed by rotation (d) None of the above
37. Reflection of a point about x-axis, followed by a counter-clockwise rotation of 90° , is equivalent to reflection about the line
 (a) $x = -y$ (b) $y = -x$ (c) $x = y$ (d) $x + y = 1$
- *38. Which one of the following is not a linear transformation?
 (a) $F : R^3 \rightarrow R^2$ defined by $f(x, y, z) = (x, z)$
 (b) $F : R^3 \rightarrow R^3$ defined by $f(x, y, z) = (x, y - 1, z)$
 (c) $F : R^2 \rightarrow R^2$ defined by $f(x, y) = (2x, y - x)$
 (d) $F : R^2 \rightarrow R^2$ defined by $f(x, y) = (y, x)$
39. Raster systems display a picture from a definition in a
 (a) display file program (b) frame buffer
 (c) display controller (d) none of the above
40. Back face removal is an example of
 (a) object space method (b) image space method
 (c) combination of both (d) none of the above
41. A bilinear transformation can be simulated by the transformations
 (a) translation, rotation and stretching (b) translation and rotation
 (c) rotation, stretching and inversion (d) rotation, stretching, inversion and translation
42. Choose the correct answers.
 To construct the rectangle $ABCD$, it is enough if
 (a) the length and breadth are given
 (b) the vertices A and B are given
 (c) the vertex A and the length of the diagonal are given
 (d) the vertices A and C are given
43. A raster colour display processor supports a resolution of 1024×800 with upto 16 million colours simultaneously displayable. What will be the approximate size (in bytes) of the frame buffer used in the display processor?
 (a) 1.2×10^6 (b) 2.4×10^6 (c) 16×10^6 (d) 10^5
44. A Bezier cubic curve with control points P_0, P_1, P_2, P_3 is defined by the equation

$$f(u) = \sum_{i=0}^3 P_i B_i^3(u)$$

B_2^3 is

- (a) $(1-u)^3$ (b) u^3 (c) $3u(1-u)^2$ (d) $3u^2(1-u)$
45. Choose the incorrect statement from the following about the basic ray tracing technique used in image synthesis.
 (a) In this technique, rays are cast from the eye point through every pixel on the screen.
 (b) In this technique, viewing transformations are not applied to the scene prior to rendering.

53. If the eccentricity of a conic is less than one then it is a
(a) circle (b) parabola (c) ellipse (d) hyperbola
54. Parabola can be got from a right circular cone, by cutting it through a plane that is
(a) parallel to the side of the cone (b) perpendicular to the axis of the cone
(c) a tangent to the cone (d) parallel to the axis of the cone
55. Fractals deal with curves that are
(a) irregularly irregular (b) regularly irregular
(c) irregularly regular (d) regularly regular
- *56. A circle, if scaled in only one dimension becomes a/an
(a) parabola (b) hyperbola (c) ellipse (d) remains a circle
- *57. Let R be the radius of a circle. The angle subtended by an arc of length R at the centre of the circle is
(a) 1 degree (b) 1 radian
(c) 45 degrees (d) impossible to determine
- *58. Choose the correct statement.
Given three non-collinear points,
(a) it is always possible to draw a circle passing through the three points.
(b) it may or may not be possible to draw a circle passing through the three points.
(c) it is impossible to draw a circle passing through the three points
(d) none of the above
- *59. $(2,4)$ is a point on a circle that has centre at the origin. Which of the following point(s) is/are also on the circle?
(a) $(2, -4)$ (b) $(-2, 4)$ (c) $(4, -2)$ (d) $(-4, 2)$
60. Aspect ratio is generally defined as the ratio of the
(a) vertical to horizontal points
(b) horizontal to vertical points
(c) vertical to (horizontal + vertical) points
(d) either (a) or (b), depending on the convention followed
- *61. Let $F: R^2 \rightarrow R^2$ be the mapping defined by $F(x, y) = (x/3, y/4)$. The image under F of the ellipse $x^2/9 + y^2/16 = 1$, is
(a) the circle $x^2 + y^2 = 1$ (b) the line $x/3 + y/4 = 1$
(c) the ellipse $x^2/27 + y^2/64 = 1$ (d) none of the above

The next three questions are based on this window.

A rectangle is bound by the lines $x = 0$; $y = 0$; $x = 5$ and $y = 3$.

- *62. The line segment joining $(-1, 0)$ and $(4, 5)$, if clipped against this window will connect the points
(a) $(0, 1)$ and $(3, 3)$ (b) $(0, 1)$ and $(2, 3)$
(c) $(0, 1)$ and $(4, 5)$ (d) none of the above

7. If the equation of the curve is unaltered, if x is replaced by y and y by x , then the curve will be symmetric about the line $x = y$.
11. Standard equation of a parabola is $y^2 = 4ax$. Put $x = at^2$ and solve for y .
12. x - increment = $x_2 - x_1 / \max((x_2 - x_1), (y_2 - y_1))$
 y - increment = $y_2 - y_1 / \max((x_2 - x_1), (y_2 - y_1))$
13. $y = x^2 + (k - 1)x + 9 = (x + (k - 1)/2)^2 - ((k - 1)/2)^2 + 9$
 For the entire graph to lie above the x -axis, y should be greater than 0, for all x .
 So, $9 - ((k - 1)/2)^2 > 0$. i.e., $(k - 7)(k + 5) < 0$ or $-5 < k < 7$
15. $X_{(\text{view port})} = (XV_{\max} - XV_{\min})(XW - XW_{\min}) / (XW_{\max} - XW_{\min}) + XV_{\min}$
 $Y_{(\text{view port})} = (YV_{\max} - YV_{\min})(YW - YW_{\min}) / (YW_{\max} - YW_{\min}) + YV_{\min}$
16. ADDRESS(x, y) = ADDRESS(0, 0) + $y((x - \text{max}_x) + 1) + x$
24. (a) and (c) are even functions, because $f(x) = f(-x)$. (b) is neither even nor odd as $f(x) \neq f(-x)$ and $-f(x) \neq f(-x)$
28. For (a), solving the equation $f(x + T) = f(x)$, we get $T = 1$ as the period. (b) is periodic with period π . (c) and (d) are not periodic.
34. If (0, 0) is substituted in the equation, we get 0, which is less than 2. So, any point on the same side as that of the origin, should yield a value less than 2, when substituted in the equation. Hence the result.

35. The determinant $\begin{vmatrix} i & j & k \\ a & b & c \\ 1 & 3 & 1 \end{vmatrix} = (2, 1, 6)$

gives the three equations, $b - 3c = 2$; $c - a = 1$; $3a - b = 6$. This system of equations, has no solution as using the second equation in the third gives $b - 3c = -3$, which contradicts the first.

36. Check by multiplying the corresponding transformation matrices. Also refer Qn.25.
38. A function $F(x, y) \rightarrow (a, b)$ is linear if $F(ax, ay) = aF(x, y)$ and $F(a+x, b+y) = F(a, b) + F(x, y)$. The functions given in options (a), (c), (d) satisfy these two conditions but option (b) doesn't.
52. Storing without any type of coding, needs $15 \times 15 = 225$ units of memory. Using run-length coding, the first row needs 4 units, each of the rows from 2 to 6 needs 6 units and the rest of the rows (from 7 to 15) needs 2 units each. So, totally $4 + 6 \times 5 + 2 \times 9 = 52$ units. The compression achieved is $52/225$, which is roughly $1/9$.
56. Let it be scaled in Y -axis with a factor k . The equation of the circle $x^2 + y^2 = a^2$, after scaling becomes $x^2 + (ky)^2 = a^2$. This can be written as $x^2/a^2 + y^2/(a/k)^2 = 1$. This is an ellipse.
57. Length of arc = Length of radius \times angle subtended in radians.
58. The three given points form a triangle. This triangle will have a circum-circle that touches all the three points.
59. Since the circle with centre at the origin, is symmetric about the X -axis, Y -axis, the line $X = Y$ and the line $X = -Y$, the reflection of (2, 4) about these axes, will also be points on the circle.

61. (X, Y) in the transformed co-ordinate system corresponds to $(x/3, y/4)$ of the old system. So the given ellipse transforms to $X^2 + Y^2 = 1$.
62. The equation of the line joining $(-1, 0)$ and $(4, 5)$ is $x - y + 1 = 0$. This cuts the window boundaries $x = 0$ and $y = 3$ at the points $(0, 1)$ and $(2, 3)$ respectively.
63. A point (x, y) will be inside the window, if $0 < x < 5$ and $0 < y < 3$. So, the points $(1, 1)$ and $(4, 2)$, both lie within the window. So, it is already clipped.
64. This line cuts the x -axis at $(-2, 0)$ and y -axis at $(0, 4)$. So, it lies totally outside the window and so cannot be clipped.
71. The equation of the line joining V and A is given by $x = t+3; y = t+6; z = 4-t$. Since B and C satisfy this, all the four points are collinear. We can find that $t = 0$ for A , $t = -1$ for B , $t = -2$ for V and $t = -3$ for C . From these values it is clear that these points lie in the order C, V, B, A . Hence the answer.