Congratulations! You passed!

Grade received 78.94% **Latest Submission Grade** 78.95% **To pass** 70% or higher

Go to next item

1. Which of the following issues does backlighting address when capturing binary images? **0 / 2 points**

- (•) Object Occlusion
- ( ) Transparent Objects
- ( ) Reflective Objects
- ( ) Color Variation on Objects

Incorrect

2. How far is the point $(1, 10)$ from the line $4y = 3x + 2$? **2 / 2 points**

- ( ) 0
- (•) 7
- ( ) 2
- ( ) 13

Correct
We know the perpendicular distance of a point (x, y) from a line $ax + by + c = 0$ is $r = \left|\frac{ax+by+c}{\sqrt{a^2+b^2}}\right|$

3. The axis of minimum second moment of the binary image of an object passes through the center (centroid) of its area. **1 / 1 point**

- (•) True
- ( ) False

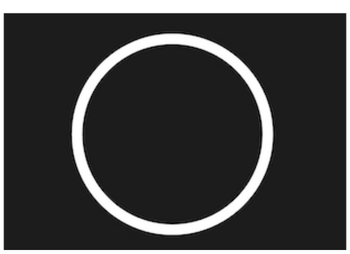
Correct
Let the equation of the straight line corresponding to the axis of minimum second moment be $x \sin\theta - y\cos\theta + \rho = 0$. If E is the second moment about the axis, by setting $\frac{\partial E}{\partial \rho} = 0$, we get $A(\bar{x}\sin\theta - \bar{y}\cos\theta + \rho) = 0$, where A is the area of the binary image of the object and $(\bar{x}, \bar{y})$ is its centroid.

4. Let the origin of the coordinate frame of a binary image of an object be located at the centroid of the binary image. If *a* and c are the second moments of the binary image with respect to the *x* axis and *y* axis, and b is the product moment, the orientation of the object can be determined using: **2 / 2 points**

- (•) $\tan 2\theta = \frac{b}{a-c}$
- ( ) $\theta = a + b + c$
- ( ) $\sin\theta = a \cdot b \cdot\ c$
- ( ) $\tan\theta = \frac{b}{a-c}$

Correct
This is the expression obtained by setting $\frac{\partial E}{\partial \theta} = 0$, where E is the second moment. The above expression has two solutions corresponding to the axes of minimum and maximum second moment.

5. **2 / 2 points**



Consider the ring shown here. Its axis of minimum inertia is:

- The x axis
- The y axis
- The diagonal $y = x$
- Not unique

Correct

All axes passing through the center of the ring produce the same second moment. Therefore, there is an infinite number of solutions.

6. Which of the following equations correctly represents the second moment with respect to the center (a) as a function of the zeroth, first and second moments with respect to its origin $(A, \bar{x}, \bar{y}, a')$?

2 / 2 points

- $a = a' - 3\bar{x}^2 A$
- $a = a' + \bar{x}^2 + A$
- $a = a' - \bar{x}^2 A$
- $a = a' - 3\bar{x} A$

Correct

Derivation:

$$
\begin{aligned}
a &= \sum\sum (i - \bar{x})^2 b_{ij} \\
&= \sum\sum (i^2 - 2i\bar{x} + \bar{x}^2) b_{ij} \\
&= \sum\sum i^2 b_{ij} - 2\bar{x} \sum\sum i b_{ij} + \bar{x}^2 \sum\sum b_{ij} \\
&= a' - 2\bar{x}(A\bar{x}) + \bar{x}^2 A \\
&= a' - \bar{x}^2 A
\end{aligned}
$$

7.

2 / 2 points

0	1	1	1	0	0
0	1	0	1	1	0
0	1	0	1	0	1
0	1	1	0	0	0
0	0	0	0	1	1
0	1	0	0	1	1
1	0	0	0	0	0

For the binary image above, which of the following statements about connectedness is false:

- Under 8-Connectedness, there are 3 components
- Under 4-Connectedness, there are 5 components
- Jordan's Curve Theorem is satisfied under 8-Connectedness
- Jordan's Curve Theorem is violated under 4-Connectedness

Correct

Under 8-Connectedness, the component on top would form a connected ring, but the background inside that ring would still be considered to belong to the background outside of it, violating the theorem.

8.

2 / 2 points

0	0	0	A	0	0
0	0	B	0	A	0
0	0	0	0	0	0
0	0	C	0	0	D
E	0	C	0	F	D

0	E	0	C	F	D
0	0	0	0	0	0

Which of the following equivalence tables is produced at the end of a sequential labelling algorithm on the binary image above?

- ( )

A ≡ B
C≡F≡D≡E

- (•)

A
B
C≡F≡D
E

- ( )

A
B
C≡F≡D≡E

- ( )

A ≡ B
C≡F≡D
E

Correct
Because of asymmetry, B is not equivalent to A and E is not equivalent to C, F or D

9. 0 / 2 points

0	0	0	0	0	0	0
1	1	1	0	1	1	1
1	0	1	0	1	0	1
1	0	1	0	1	0	1
1	1	1	0	1	1	1
0	0	0	0	0	0	0
0	1	1	1	1	1	0
0	0	1	1	1	0	0

What is the Euler number of the binary image above?

- ( ) 3
- (•) -1
- ( ) 1
- ( ) 0

Incorrect

10. 2 / 2 points

a_{ij}	b_{ij}
0	0
0	1
1	0

➡

c_{ij}
0
1
1

1	1

1

If $a_{ij} = 1$ when the neighborhood of pixel (i, j) is an element of the neighborhood set N_0 (Euler differential 0), b_{ij} is the current value of (i, j), and c_{ij} is the new value of (i, j), repeated application of the algorithm above will:

- ○ Thin the object
- ○ Duplicate the object
- ◉ Grow the object
- ○ Generate a wave

Correct

The algorithm converts all pixels just outside the object from 0 to 1, as long as the conversion does not create new bodies (change the Euler number). As a result, with each iteration, the object grows in size.