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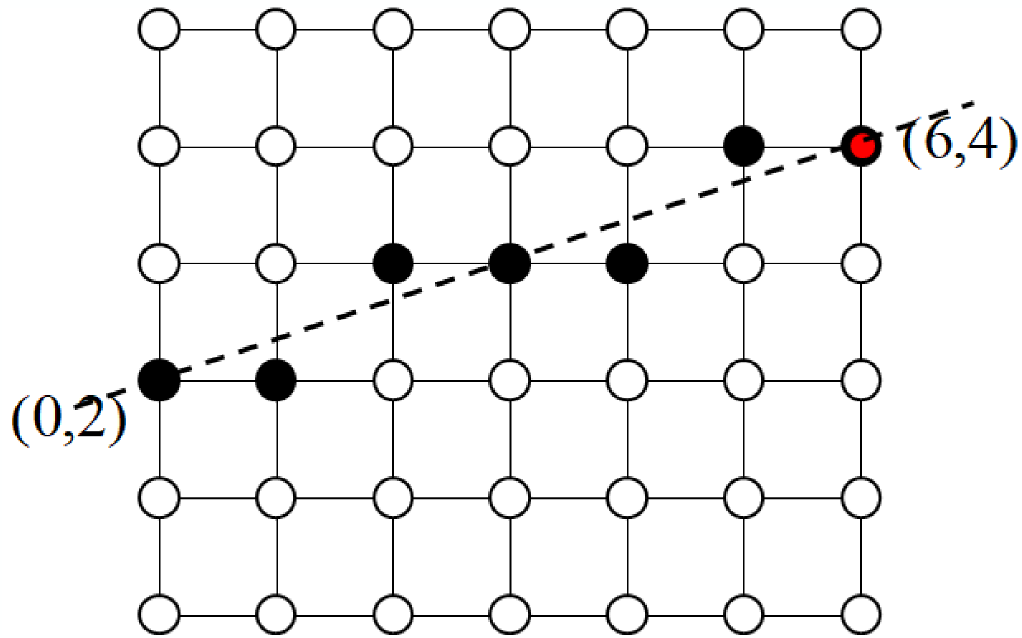
Digital Differential Analyser DDA

Cons) Floating-point operations are expensive

- A line in 2D is defined as: $y = kx + m$ where: x and y are variables (screen coordinates)
- Starts at (x_0, y_0) and ends at (x_1, y_1)
- slope: $k = {}^{\Delta y}/_{\Delta x} = (y_1 - y_0)/(x_1 - x_0)$
- Algorithm:
  - Start at (x_0, y_0);
  - Increase x by 1 and y by k
  - repeat until $x=x_1$

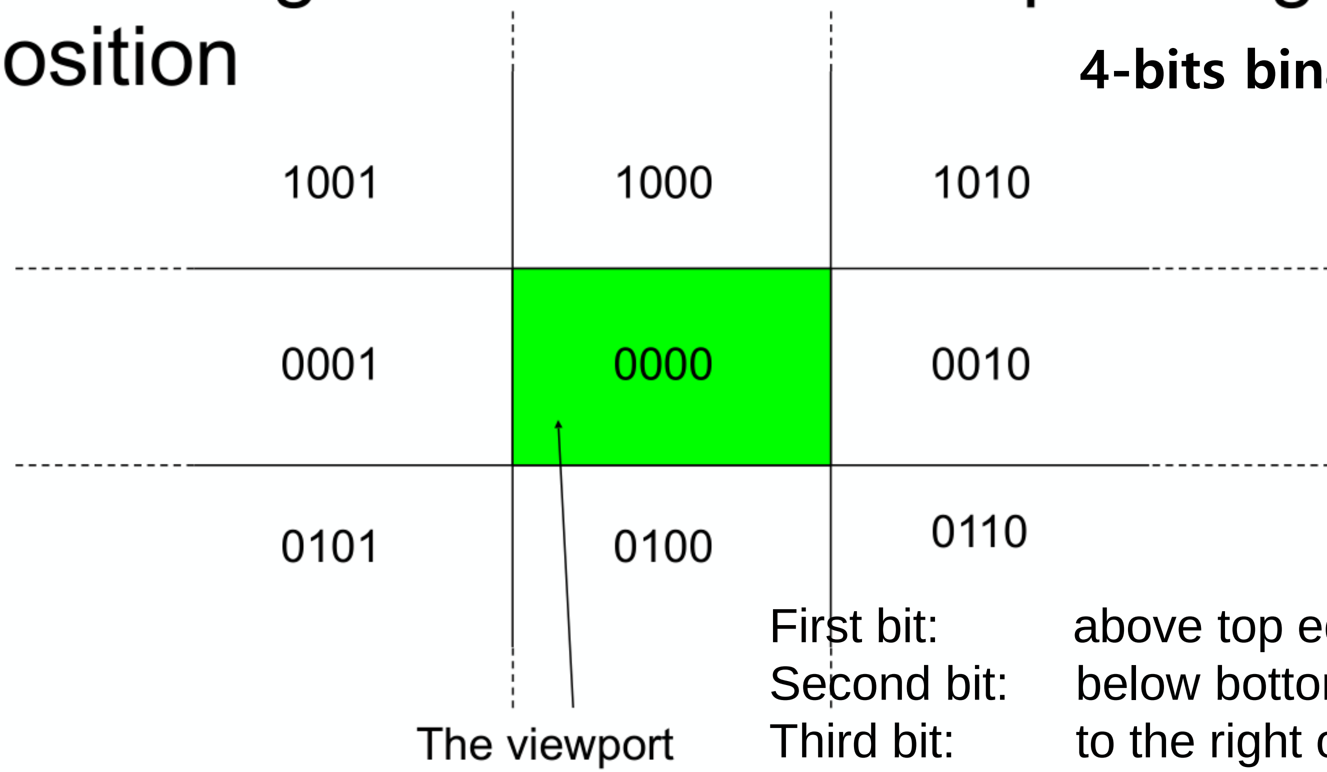


or Increase y by 1 and x by 1/k if k > 1

Cohen-Sutherland (in 2D)

- Divide space in 9 regions
- And assign codes to them depending on position

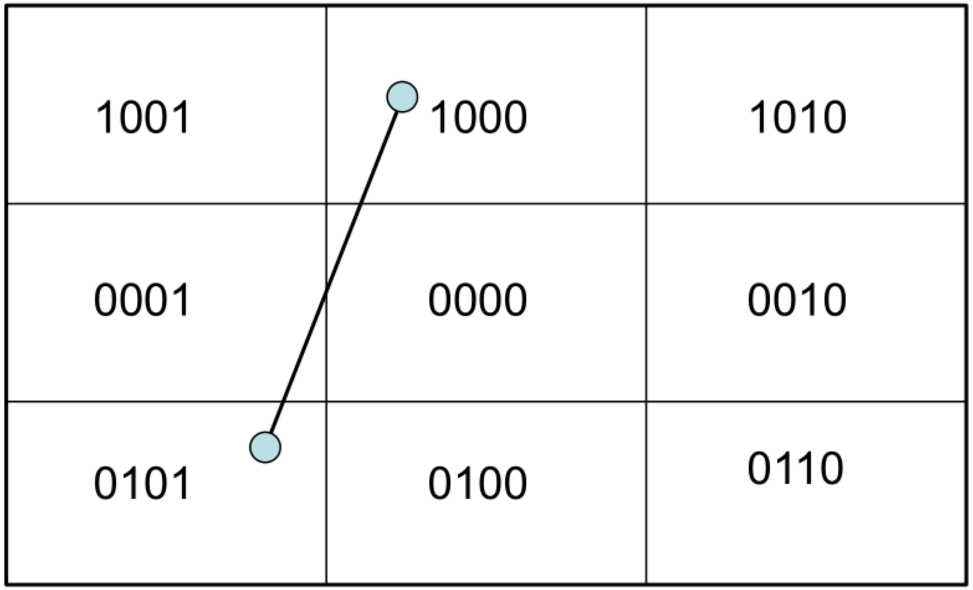
4-bits binary code



First bit: above top edge
Second bit: below bottom edge
Third bit: to the right of right edge
Fourth bit: to the left of left edge

Example

- The endpoints are assigned an outcode
  - 1000 and 0101 in this case



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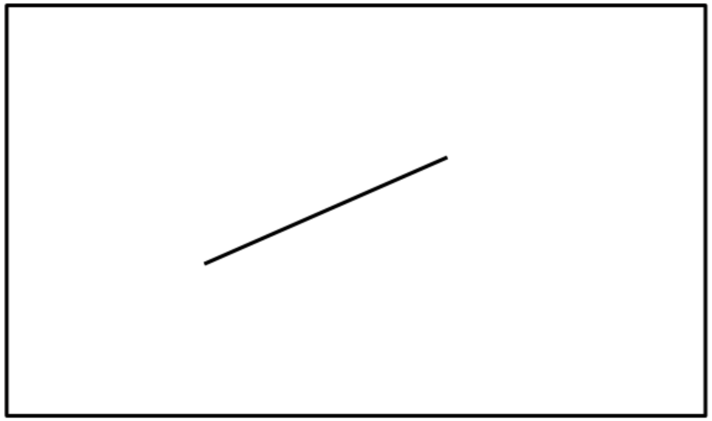
Decision based on the outcode

- $o_1 = o_2 = 0000$

  Both endpoints are inside the clipping window

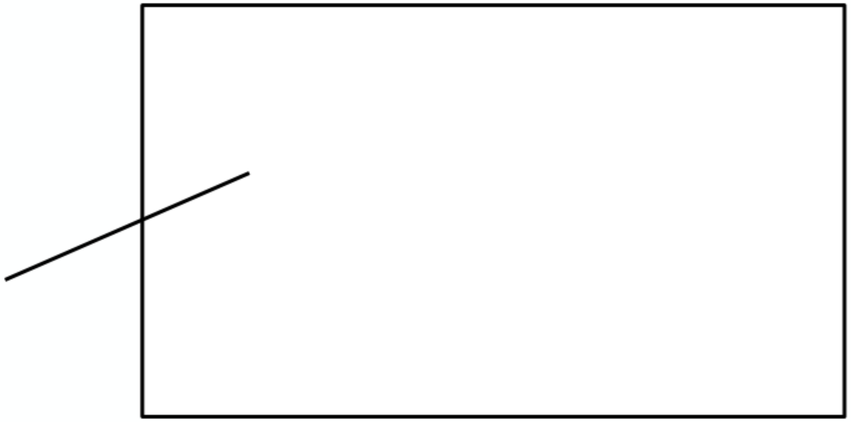


Decision based on the outcode

- $o_1 != 0000$, $o_2 = 0000$ *or vice versa*

  One endpoint is inside and the other is outside

  – The line segment must be shortened



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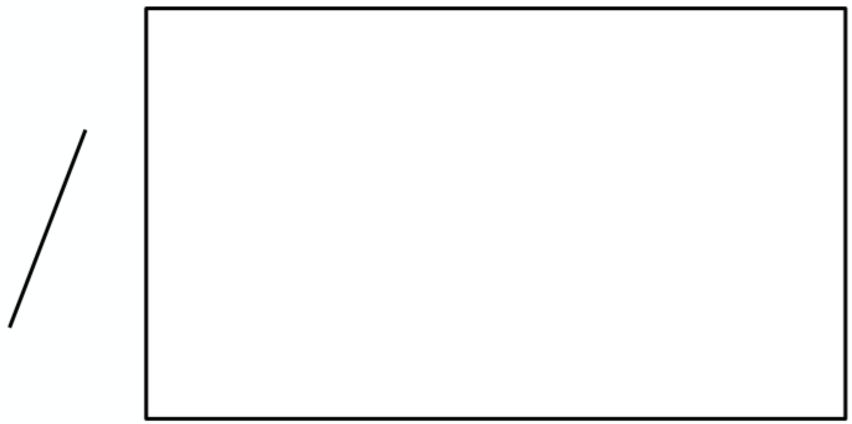
Decision based on the outcode

(bitwise AND)

- $o_1 \& o_2 != 0000$

  Both endpoints are on the same side of the clipping window

  – Trivial Reject



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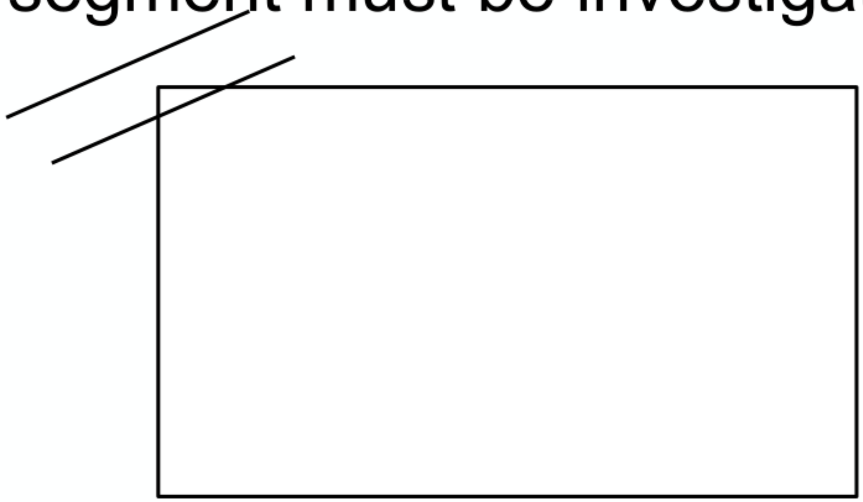
Decision based on the outcode

- $o_1 \& o_2 = 0000$

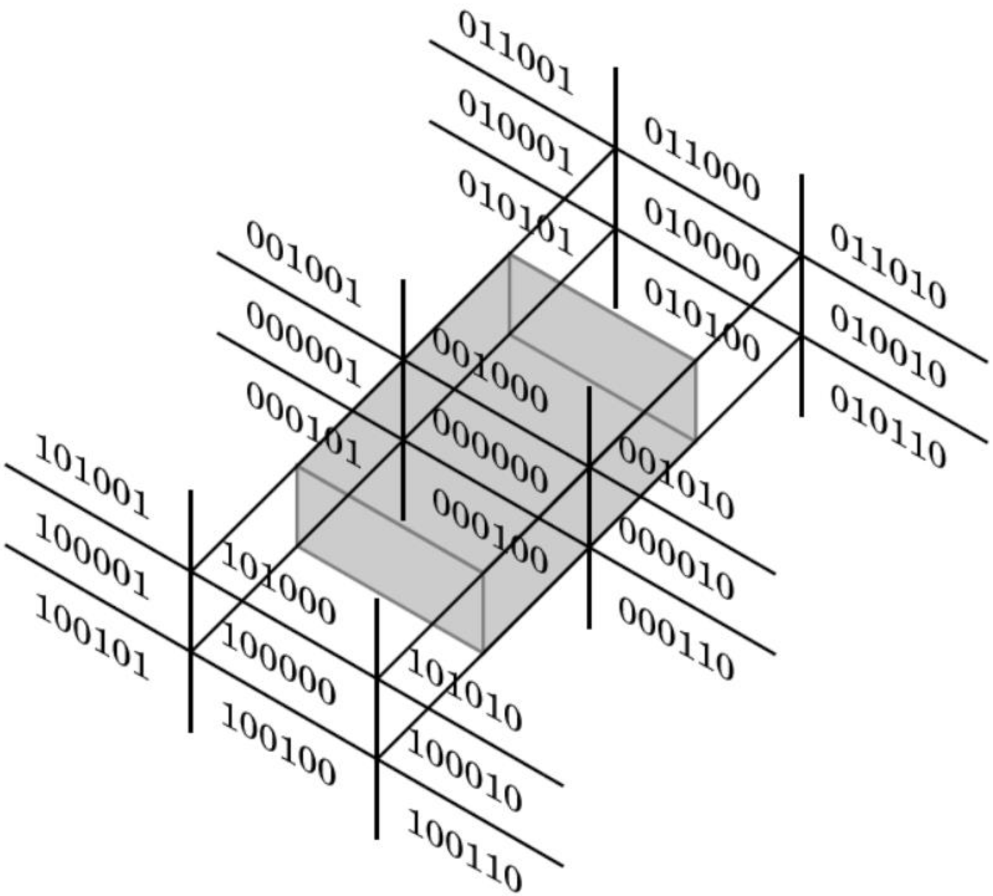
  Both endpoint are outside but outside different edges

  - The line segment must be investigated further



Cohen–Sutherland in 3D

- 27 regions with a 6 bit code



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