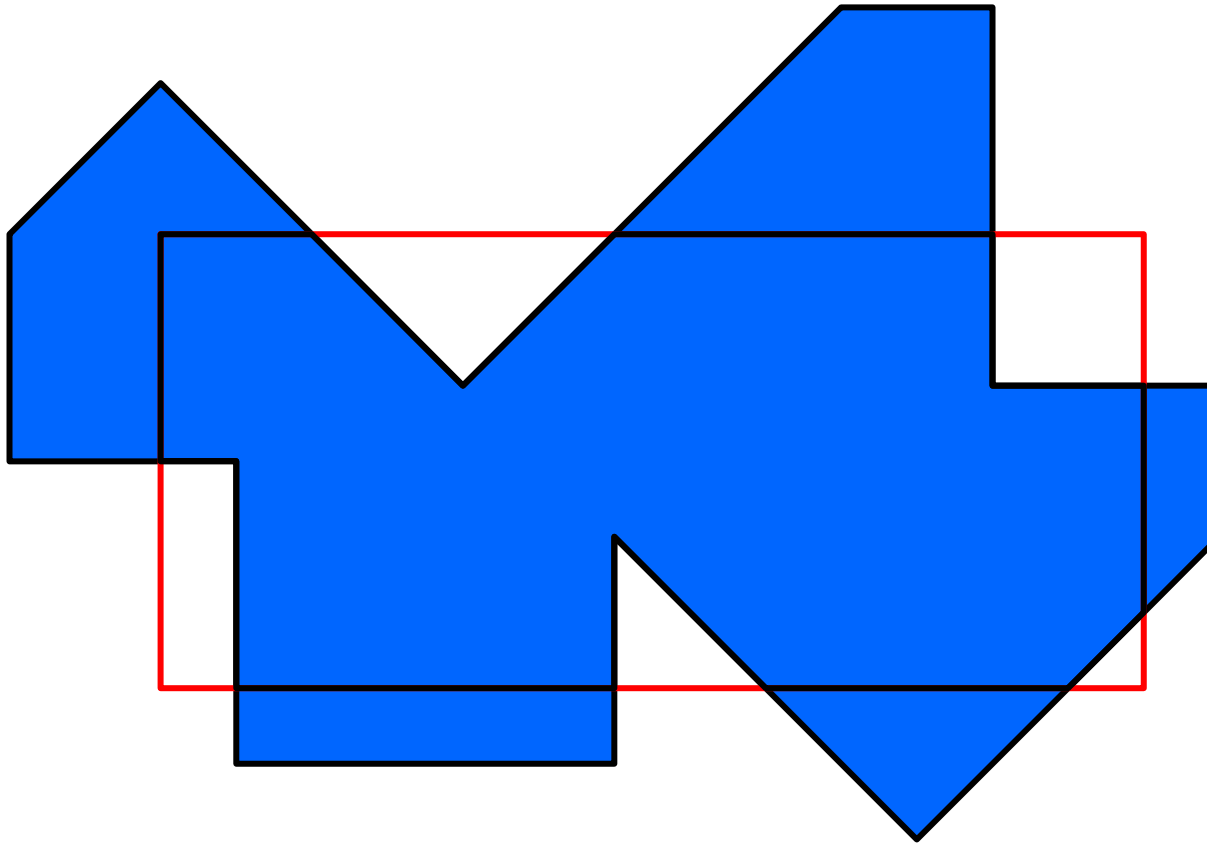


# Computergrafik SS 2014

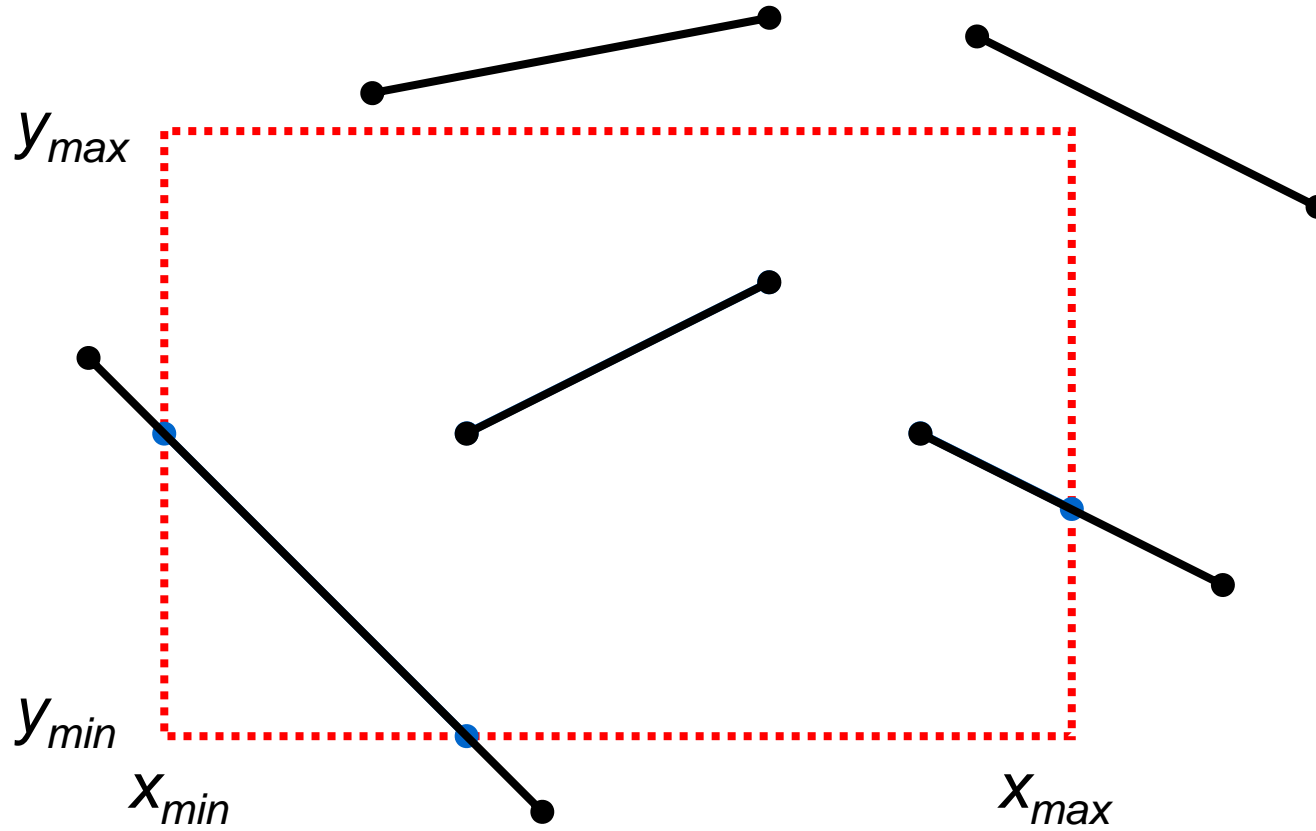
Oliver Vornberger

Kapitel 5:  
2D-Clipping

# 2D-Clipping



# Clipping von Linien



# Region Code: Definition

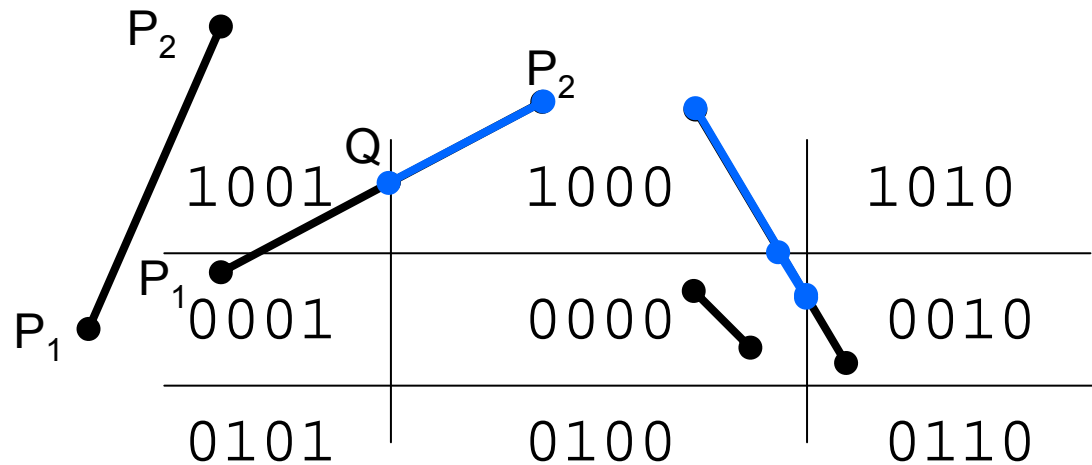
Bit 0: links    Bit1:rechts    Bit2: unten    Bit3: oben

<b>1001</b>	<b>1000</b>	<b>1010</b>
$y_{max}$		
<b>0001</b>	<b>0000</b>	<b>0010</b>
$y_{min}$		
<b>0101</b>	$x_{min}$ <b>0100</b>	$x_{max}$ <b>0110</b>

# Region Code: Berechnung

```
private static final byte CENTER = 0;
private static final byte LEFT   = 1;
private static final byte RIGHT  = 2;
private static final byte BOTTOM = 4;
private static final byte TOP    = 8;
public byte region_code (int x, int y) {
    byte c = CENTER;
    if (x < xmin) c = LEFT;
    if (x > xmax) c = RIGHT;
    if (y < ymin) c = c | BOTTOM;
    if (y > ymax) c = c | TOP;
    return c;
}
```

# Cohen & Sutherland



falls  $\text{code}(P_1) \&\& \text{code}(P_2) \neq 0 \Rightarrow$  komplett außerhalb

falls  $\text{code}(P_1) \parallel \text{code}(P_2) = 0 \Rightarrow$  komplett innerhalb

sonst: berechne Schnittpunkt  $Q$  und teste Restlinie erneut

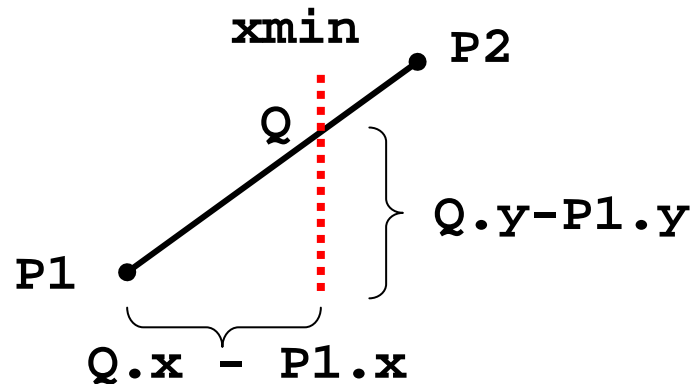
# Quiz

P1 und P2 liegen  
komplett außerhalb, falls

1001	1000	1010
0001	0000	0010
0101	0100	0110

- A** Code(P1) || code(P2) = 0  
| 0,0 %
- B** Code(P1) || code(P2) ≠ 0  
| 0,0 %
- C** Code(P1) && code(P2) = 0  
| 0,0 %
- D** Code(P1) && code(P2) ≠ 0  
| 0,0 %

# Schnittpunkte



$$\text{slope} = \frac{Q.y - P1.y}{Q.x - P1.x}$$

$$\text{slope} = \frac{P2.y - P1.y}{P2.x - P1.x}$$

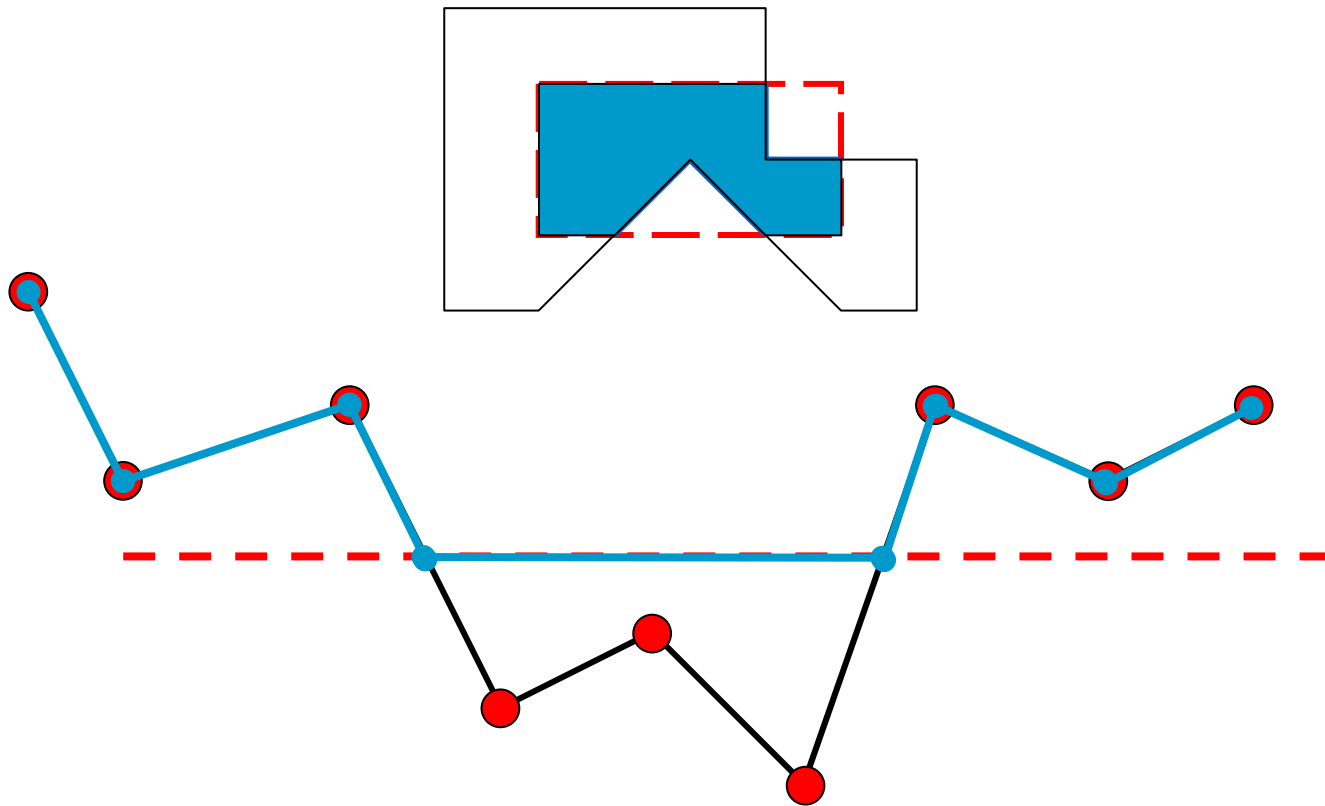
```
slope = (double)(P2.y - P1.y)/(P2.x - P1.x);  
Q.x   = xmin  
Q.y   = (int)(Q.x - P1.x)*slope + P1.y
```



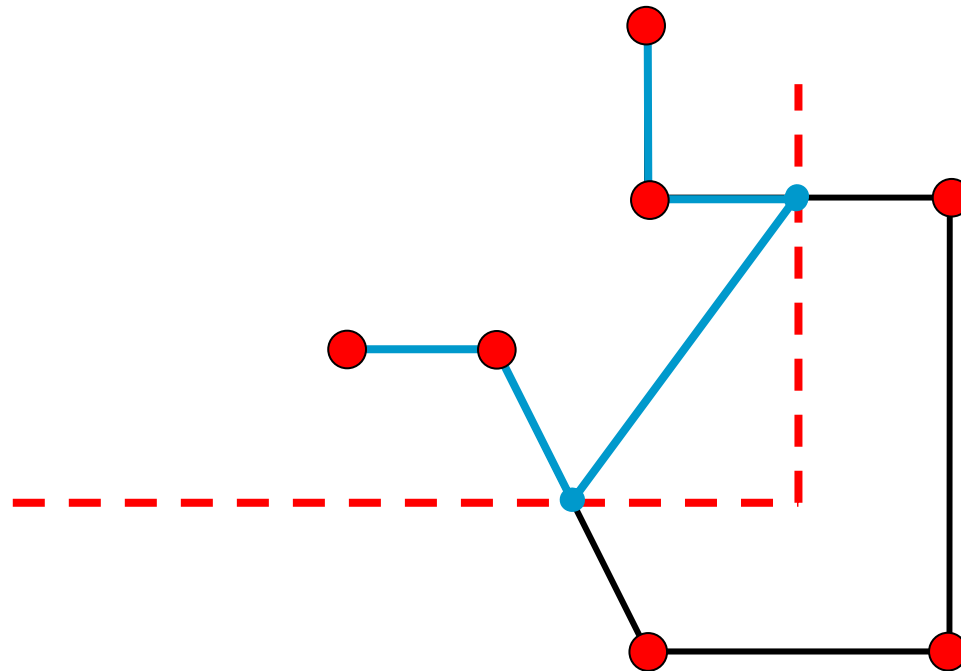
# Cohen-Sutherland

```
boolean cohen_sutherland(Point P1,  
                          Point P2,  
                          Point Q1,  
                          Point Q2){  
    // clippt Gerade P1,P2 am Fenster  
    // liefert true, falls sichtbar  
    // liefert in Q1,Q2 den sichtbaren Teil  
    ...  
}
```

# Clipping von Polygonen



# Problem bei Clip-Fenster-Ecken



# Sutherland & Hodgman

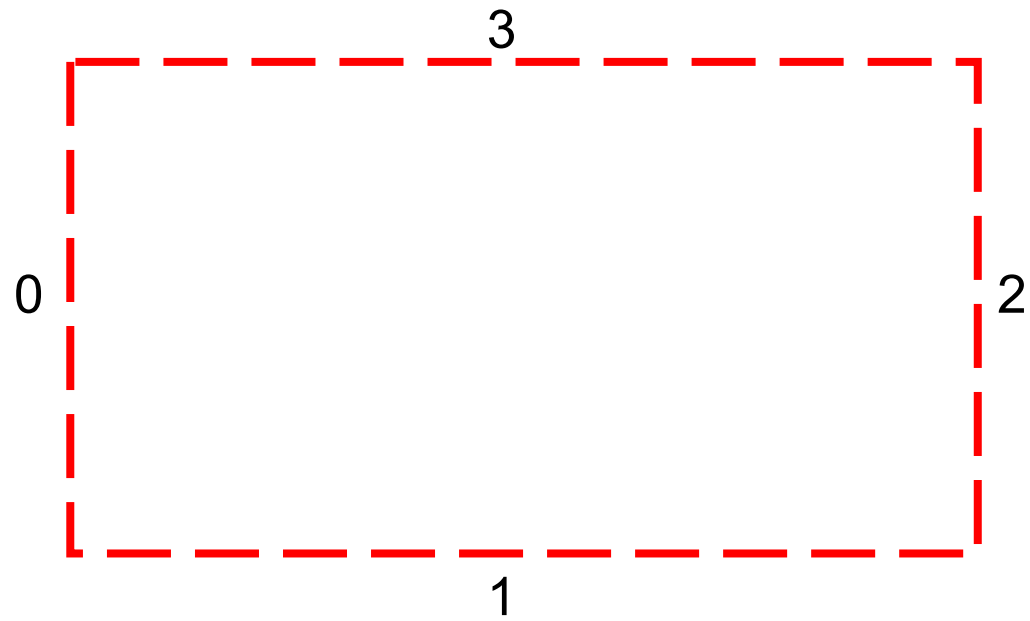
für eine Clipping-Gerade  $E$

für jeden Polygonpunkt  $P_i$ :

falls  $P_i$  sichtbar: übernahm  $P_i$

falls Kante von  $P_i$  zu  $P_{i+1}$   $E$  schneidet:  
übernahm Schnittpunkt

# 4 Clipping-Kanten



# Sichtbarkeitstest

```
boolean On_Visible_Side(  
    Point P, int wert, int fall) {  
    switch (fall) {  
        case 0: return (P.x >= wert);  
        case 1: return (P.y >= wert);  
        case 2: return (P.x <= wert);  
        case 3: return (P.y <= wert);  
    }  
}
```

# Schnittpunkt

```
boolean intersection(  
    Point P1, Point P2,  
    int wert, int fall, Point I) {  
    ...  
    P1_vis = On_Visible_Side(P1,wert,fall);  
    P2_vis = On_Visible_Side(P2,wert,fall);  
    ...  
    slope =(double)(P2.y-P1.y)/  
            (double)(P2.x-P1.x);  
    if (fall %2 == 0) {  
        I.x = (int) wert;  
        I.y = (int)(wert-P1.x)*slope + P1.y;  
    }  
    ...  
}
```

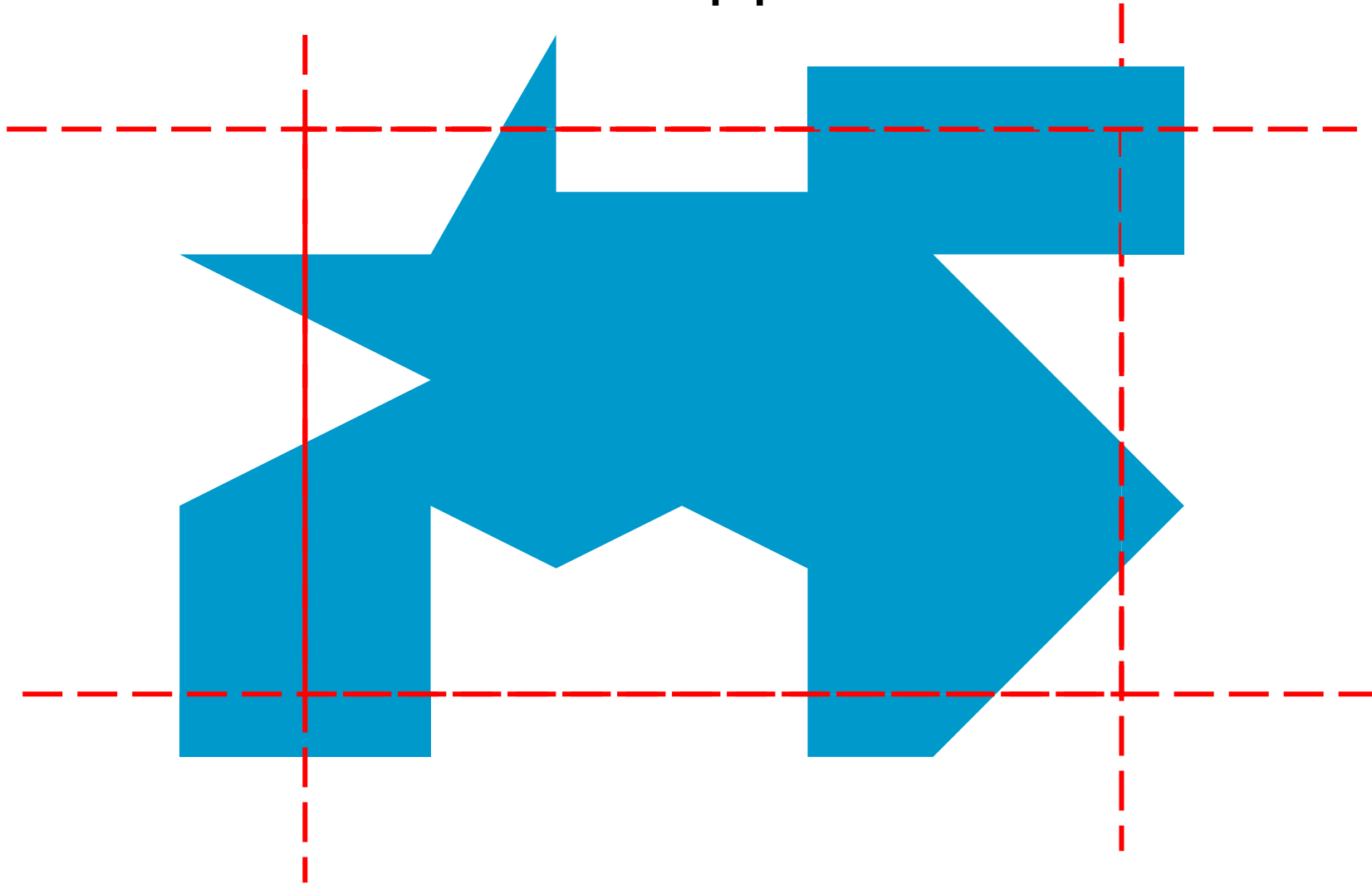
# Aufruf von Sutherland\_hodgman

```
int n;           // Zahl der Eckpunkte
Point[] points; // Polygon

n = sutherland_hodgman(n, points, xmin, 0);
n = sutherland_hodgman(n, points, ymin, 1);
n = sutherland_hodgman(n, points, xmax, 2);
n = sutherland_hodgman(n, points, ymax, 3);
```



4 x Clippen



# Quiz

Verglichen mit einem Polygon mit 8 Ecken  
ist der Rechenaufwand zum Clippen eines Kreises

**A** niedriger



**B** gleich hoch



**C** höher



**D** manchmal niedriger, manchmal höher



Number of votes: 0

# Clipping eines Kreises

