

# Object Collision Analysis

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## Corner Cell Detection

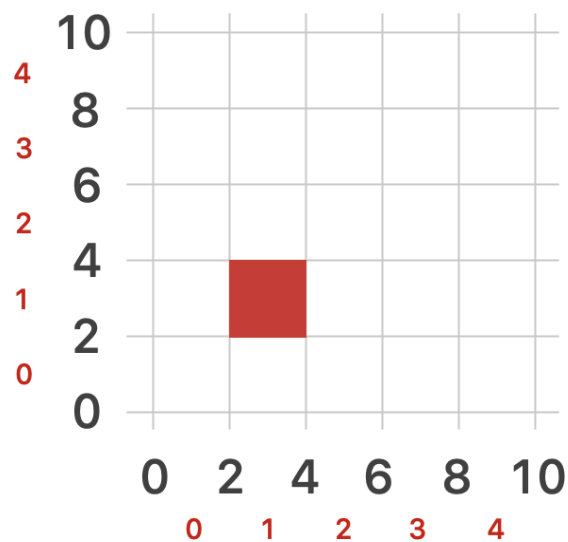
### Notations

Coordinate notation: (row, column)

X: horizontal axis

Y: vertical axis

Object corners overlap with grid corners



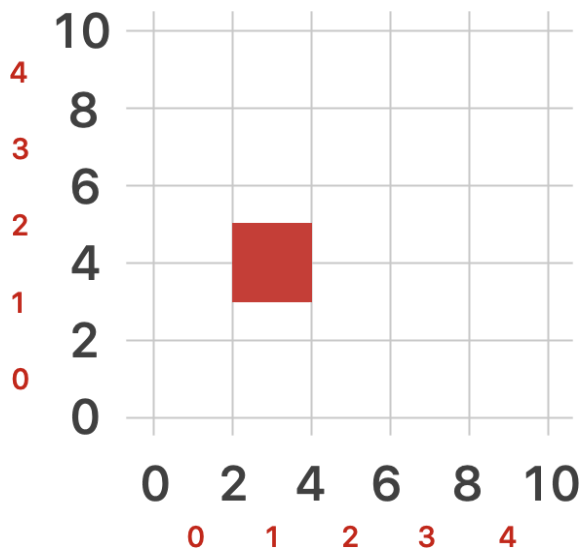
| Bottom Left Y | Bottom Left X | Object Width | Object Height | Cell Width | Cell Height |
|---------------|---------------|--------------|---------------|------------|-------------|
| 2             | 2             | 2            | 2             | 2          | 2           |

| Corner      | Y | Y Formula              | X | X Formula             |
|-------------|---|------------------------|---|-----------------------|
| Top Left    | 4 | $Y + \text{ObjHeight}$ | 2 | X                     |
| Top Right   | 4 | $Y + \text{ObjHeight}$ | 4 | $X + \text{ObjWidth}$ |
| Bottom Left | 2 | Y                      | 2 | X                     |

|              |   |   |   |              |
|--------------|---|---|---|--------------|
| Bottom Right | 2 | Y | 4 | X + ObjWidth |
|--------------|---|---|---|--------------|

| Corner       | Row | Row Formula                                        | Column | Column Formula                                   |
|--------------|-----|----------------------------------------------------|--------|--------------------------------------------------|
| Top Left     | 1   | $((Y + \text{ObjHeight}) / \text{CellHeight}) - 1$ | 1      | $X / \text{CellWidth}$                           |
| Top Right    | 1   | $(Y + \text{ObjHeight}) / \text{CellHeight} - 1$   | 1      | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |
| Bottom Left  | 1   | $Y / \text{CellHeight}$                            | 1      | $X / \text{CellWidth}$                           |
| Bottom Right | 1   | $Y / \text{CellHeight}$                            | 1      | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |

## Object corners on vertical grid lines



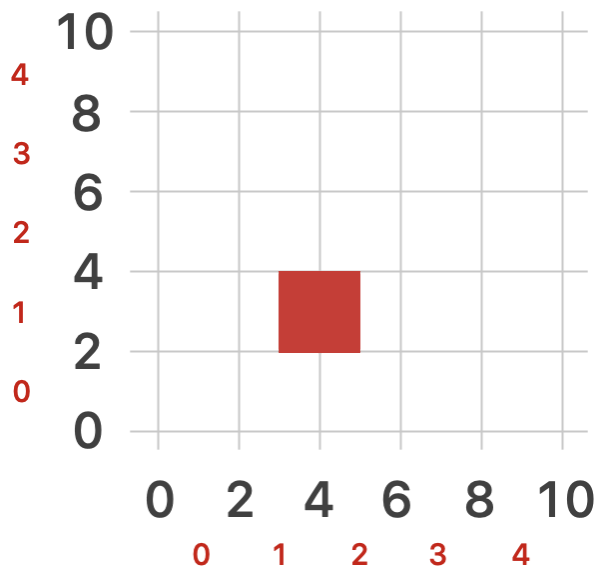
| Bottom Left Y | Bottom Left X | Object Width | Object Height | Cell Width | Cell Height |
|---------------|---------------|--------------|---------------|------------|-------------|
| 3             | 2             | 2            | 2             | 2          | 2           |

| Corner       | Y | Y Formula     | X | X Formula    |
|--------------|---|---------------|---|--------------|
| Top Left     | 5 | Y + ObjHeight | 2 | X            |
| Top Right    | 5 | Y + ObjHeight | 4 | X + ObjWidth |
| Bottom Left  | 3 | Y             | 2 | X            |
| Bottom Right | 3 | Y             | 4 | X + ObjWidth |

| Corner | Row | Row Formula | Column | Column Formula |
|--------|-----|-------------|--------|----------------|
|--------|-----|-------------|--------|----------------|

|              |   |                                              |   |                                                  |
|--------------|---|----------------------------------------------|---|--------------------------------------------------|
| Top Left     | 2 | $(Y + \text{ObjHeight}) / \text{CellHeight}$ | 1 | $X / \text{CellWidth}$                           |
| Top Right    | 2 | $(Y + \text{ObjHeight}) / \text{CellHeight}$ | 1 | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |
| Bottom Left  | 1 | $Y / \text{CellHeight}$                      | 1 | $X / \text{CellWidth}$                           |
| Bottom Right | 1 | $Y / \text{CellHeight}$                      | 1 | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |

## Object corners on horizontal grid lines



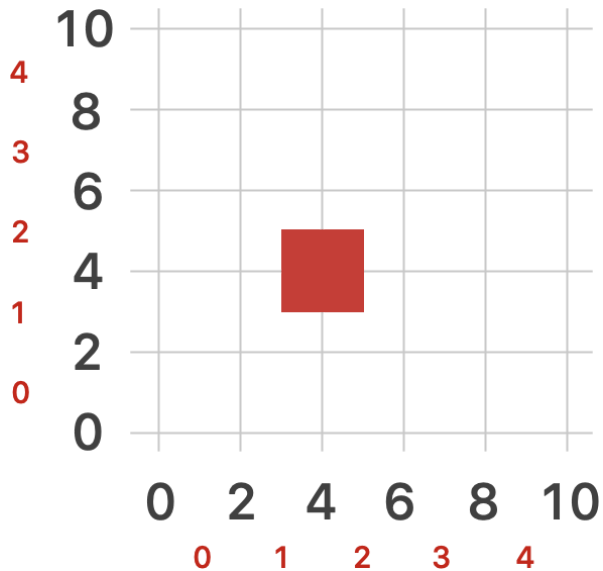
| Bottom Left Y | Bottom Left X | Object Width | Object Height | Cell Width | Cell Height |
|---------------|---------------|--------------|---------------|------------|-------------|
| 2             | 3             | 2            | 2             | 2          | 2           |

| Corner       | Y | Y Formula              | X | X Formula             |
|--------------|---|------------------------|---|-----------------------|
| Top Left     | 4 | $Y + \text{ObjHeight}$ | 3 | $X$                   |
| Top Right    | 4 | $Y + \text{ObjHeight}$ | 5 | $X + \text{ObjWidth}$ |
| Bottom Left  | 2 | $Y$                    | 3 | $X$                   |
| Bottom Right | 2 | $Y$                    | 5 | $X + \text{ObjWidth}$ |

| Corner    | Row | Row Formula                                        | Column | Column Formula                             |
|-----------|-----|----------------------------------------------------|--------|--------------------------------------------|
| Top Left  | 1   | $((Y + \text{ObjHeight}) / \text{CellHeight}) - 1$ | 1      | $X / \text{CellWidth}$                     |
| Top Right | 1   | $((Y + \text{ObjHeight}) / \text{CellHeight}) - 1$ | 2      | $(X + \text{ObjWidth}) / \text{CellWidth}$ |

|              |   |                         |   |                                            |
|--------------|---|-------------------------|---|--------------------------------------------|
| Bottom Left  | 1 | $Y / \text{CellHeight}$ | 1 | $X / \text{CellWidth}$                     |
| Bottom Right | 1 | $Y / \text{CellHeight}$ | 2 | $(X + \text{ObjWidth}) / \text{CellWidth}$ |

Object corners not on grid lines



| Bottom Left Y | Bottom Left X | Object Width | Object Height | Cell Width | Cell Height |
|---------------|---------------|--------------|---------------|------------|-------------|
| 3             | 3             | 2            | 2             | 2          | 2           |

| Corner       | Y | Y Formula              | X | X Formula             |
|--------------|---|------------------------|---|-----------------------|
| Top Left     | 5 | $Y + \text{ObjHeight}$ | 3 | $X$                   |
| Top Right    | 5 | $Y + \text{ObjHeight}$ | 5 | $X + \text{ObjWidth}$ |
| Bottom Left  | 3 | $Y$                    | 3 | $X$                   |
| Bottom Right | 3 | $Y$                    | 5 | $X + \text{ObjWidth}$ |

| Corner       | Row | Row Formula                                  | Column | Column Formula                             |
|--------------|-----|----------------------------------------------|--------|--------------------------------------------|
| Top Left     | 2   | $(Y + \text{ObjHeight}) / \text{CellHeight}$ | 1      | $X / \text{CellWidth}$                     |
| Top Right    | 2   | $(Y + \text{ObjHeight}) / \text{CellHeight}$ | 2      | $(X + \text{ObjWidth}) / \text{CellWidth}$ |
| Bottom Left  | 1   | $Y / \text{CellHeight}$                      | 1      | $X / \text{CellWidth}$                     |
| Bottom Right | 1   | $Y / \text{CellHeight}$                      | 2      | $(X + \text{ObjWidth}) / \text{CellWidth}$ |

## Overall

### Top Left

| Cases                                              | Row Formula                                        |
|----------------------------------------------------|----------------------------------------------------|
| $(Y + \text{ObjHeight}) \% \text{CellHeight} == 0$ | $((Y + \text{ObjHeight}) / \text{CellHeight}) - 1$ |
| $(Y + \text{ObjHeight}) \% \text{CellHeight} != 0$ | $(Y + \text{ObjHeight}) / \text{CellHeight}$       |

### Top Right

| Cases                                              | Row Formula                                      |
|----------------------------------------------------|--------------------------------------------------|
| $(Y + \text{ObjHeight}) \% \text{CellHeight} == 0$ | $(Y + \text{ObjHeight}) / \text{CellHeight} - 1$ |
| $(Y + \text{ObjHeight}) \% \text{CellHeight} != 0$ | $(Y + \text{ObjHeight}) / \text{CellHeight}$     |

| Cases                                            | Column Formula                                   |
|--------------------------------------------------|--------------------------------------------------|
| $(X + \text{ObjWidth}) \% \text{CellWidth} == 0$ | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |
| $(X + \text{ObjWidth}) \% \text{CellWidth} != 0$ | $(X + \text{ObjWidth}) / \text{CellWidth}$       |

### Bottom Right

| Cases                                            | Column Formula                                   |
|--------------------------------------------------|--------------------------------------------------|
| $(X + \text{ObjWidth}) \% \text{CellWidth} == 0$ | $((X + \text{ObjWidth}) / \text{CellWidth}) - 1$ |
| $(X + \text{ObjWidth}) \% \text{CellWidth} != 0$ | $(X + \text{ObjWidth}) / \text{CellWidth}$       |