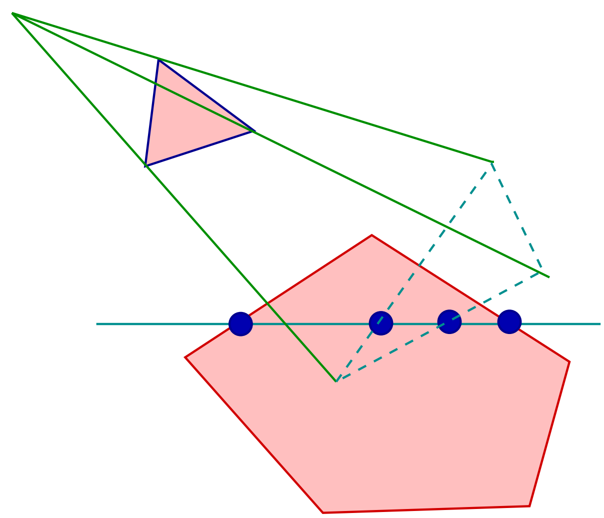
# Shadow Generation

$$I_\lambda = k_a I_{a\lambda} O_{a\lambda} + \sum_{i=1}^{k} S_i f_{att} I_{L_i\lambda} \left[k_d O_{d\lambda} (\mathbf{N} \cdot \mathbf{L}_i) + k_s (\mathbf{R} \cdot \mathbf{V})^n\right]$$

$$S_i = \begin{cases} 0 & \text{if light } i \text{ is blocked,} \\ 1 & \text{if light } i \text{ is not blocked.} \end{cases}$$



## Scan-line method

- ☆ Use light source as the center of projection.
- ☆ Project the edges of polygons that cast shadows on the polygons intersecting the scan line.
- ☆ Whenever the scan line visits one of the projected points, change the intensity.

# Shadow Generation

## Two-Pass Object Precision Algorithm:

- ☆ Find the portion of each polygon visible from the light source.
- ☆ Decompose each polygon into subpolygons, each being either completely lit or completely under dark.
- ☆ Render each polygon as folllows:
  - If the polygon is in dark, set intensity to the ambient light
    $$I_\lambda = k_a I_{a\lambda} O_{a\lambda}.$$
  - If the polygon is lit, then use ambient, diffuse, and specular reflection.
- ☆ Repeat the first two steps for each light source.

# Shadow Generation

## Two-Pass $Z$-Buffer Algorithm:

☆ Two passes

- W.r.t light source
- W.r.t. view point

☆ Compute depth information w.r.t. the light source.

*light buffer* (LB) or *shadow mask*

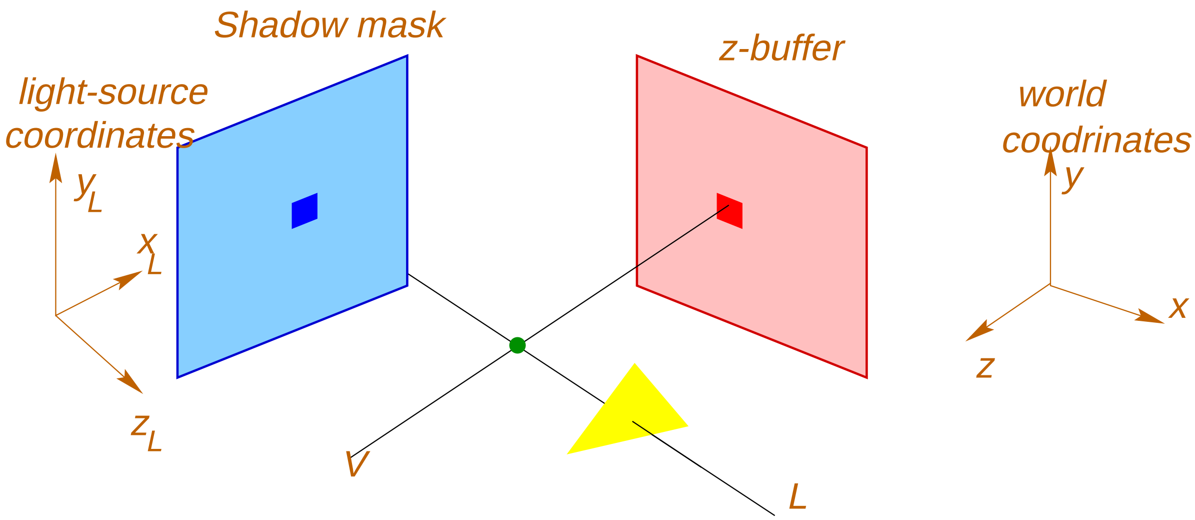
☆ Compute the value of the frame buffer at each pixel $\pi$ w.r.t. the viewpoint as follows:

- Suppose the point $p$ in the world coordinate is drawn at pixel $\pi$.
- Determine if $p$ is under shadow.
- If under shadow, use ambient light.

  Otherwise compute the lighting information at $\pi$.

☆ For multiple light sources, maintain a shadow mask for each light source.

# Shadow Generation




- ☆ Compute the pixel $(a, b)$ in the shadow mask corresponding to point $p$.
- ☆ Compute the distance $c$ of $p$ from the light source.
- ☆ Compare $c$ with $z_L = LB[a, b]$.
- ☆ If $z_L < c$, $p$ is under shadow; otherwise $p$ is lit.