Primal dual

$y_i = 0$ for all $i = 1 .. 8$

Step 1:

1 not covered $\Rightarrow y_1 = 3$ from ①

$\boxed{S_1}$ tight

$y = (3, 0, 0, 0, 0, 0, 0, 0)$

step 2:

2 not covered $\Rightarrow y_2 = 5$ from ②

$\boxed{S_2}$ tight

$y = (3, 5, 0, 0, 0, 0, 0, 0)$

Step 3:

3 not covered $\Rightarrow y_3 = 7$ from ③

$\boxed{S_3}$ tight

$y = (3, 5, 7, 0, 0, 0, 0, 0)$

Step 4:

6 not covered $\Rightarrow y_6 = 11$

$\boxed{S_4}$ tight

$y = (3, 5, 7, 0, 0, 11, 0, 0)$

Set cover: $\{S_1, S_2, S_3, S_4\}$

weight: $w(S_1) + w(S_2) + w(S_3) + w(S_4)$

$= 3 + 5 + 7 + 11$

$= 26 //$

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Assuming x_i corresponds to a set S_i (1 for S_i in set cover, otherwise S_i not in set cover)

ILP

$$\min \quad \Sigma v_i x_i = 3x_1 + 5x_2 + 7x_3 + 11x_4 + 13x_5$$

subject to constraints

$$x_1 + x_5 \geq 1$$
$$x_2 + x_6 \geq 1$$
$$x_3 + x_5 \geq 1$$
$$x_3 + x_6 \geq 1$$
$$x_4 + x_5 \geq 1$$
$$x_4 + x_6 \geq 1$$
$$x_4 + x_5 \geq 1$$
$$x_4 + x_6 \geq 1$$

Dual

$$\max \quad y_1 + y_2 + y_3 + y_4 + y_5 + y_6 + y_7 + y_7$$
subject to constraints

$$y_1 \leq 3 \qquad\qquad - ①$$
$$y_2 \leq 5 \qquad\qquad - ②$$
$$y_3 + y_4 \leq 7 \qquad\qquad - ③$$
$$y_5 + y_6 + y_7 + y_8 \leq 11 \qquad - ④$$
$$y_1 + y_3 + y_5 + y_7 \leq 13 \qquad - ⑤$$
$$y_2 + y_4 + y_6 + y_8 \leq 11 \qquad - ⑥$$