Quiz 5 Solutions

1. **Question 1(a):** 5 points

   Refer to the quiz sheet for the problem statement.

   - **Solution:**
     Find the dual LP problem.
     Version A

$$\begin{aligned} \text{Maximize} \quad & 3w_1 + 5w_2 \\ \text{Subject to} \quad & w_1 \leq 4 \\ & 2w_2 \leq 12 \\ & 3w_1 + 2w_2 \leq 18 \\ & w_1, w_2 \geq 0 \end{aligned}$$

     Make the following observations.
     - In the dual LP, the second and third slack variables are zero, so we have $w_2 = 6$ and $3w_1 + 2w_2 = 18$.
     - All slack variables in the primal are zero. This gives us no new information.
     - The optimal value is 36 in the primal. Using the strong duality theorem, we know $c^T x = b^T y$ so the value to the optimal solution in the dual must also be 36.

     Given the 2-dimensional problem, plotting the dual LP we can see that the optimal solution must occur at $(2, 6)$ which lies on $w_2 = 6$ and $3w_1 + 2w_2 = 18$.
     Version B
     Done similarly.

2. **Question 1(b):** 4 points

   Follow the algorithm to the dual simplex method.

3. **Question 1(c):** 1 point

   Follow the algorithm to the dual simplex method.