Note: There are 5 questions on 1 page(s). Submit a report written in your own words. Write your name and roll number clearly on the report.

1. Suppose we look at the final iteration of the simplex method i.e., when the optimal solution has been obtained. Find the condition under which we can say that there is an alternate optimal basic solution.

2. Exercise 3.46 [BJS, 2nd Ed.]

3. Exercise 4.5 [BJS, 2nd Ed.]

4. Exercise 4.8 [BJS, 2nd Ed.]

5. Consider the problem

$$
\begin{aligned}
&\min c^\mathsf{T} x \\
&\text{subject to } Ax \le b, \\
&\qquad\qquad x \ge 0.
\end{aligned}
\tag{P}
$$

We can convert it into standard form by adding some slack variables, say y, and then use the simplex method. Suppose in some iteration of the method, we observe a row in which a slack variable is basic, and all other coefficients are nonpositive. Then show that the corresponding constraint of (P) is redundant.