

SI152 - Numerical Optimization homework 3

Deadline: 2022-05-03 23:59:00

1. You can use Word, Latex or handwriting to complete this assignment. If you want to submit a handwritten version, scan it clearly.
2. The **report** has to be submitted as a PDF file to Blackboard, other formats are not accepted.
3. The submitted file name is **student_id+your_student_name.pdf**.
4. Late policy: You have 4 free late days for the quarter and may use up to 2 late days per assignment with no penalty. Once you have exhausted your free late days, we will deduct a late penalty of 25% per additional late day. Note: The timeout period is recorded in days, even if you delay for 1 minute, it will still be counted as a 1 late day.
5. You are required to follow ShanghaiTech's academic honesty policies. You are not allowed to copy materials from other students or from online or published resources. Violating academic honesty can result in serious sanctions.

Any plagiarism will get Zero point.

1. A factory produces three products I, II and III. The unit cost and profit of each product and the supply of raw materials A and B are shown in the following table:

unit cost / product				Total Supply
	I	II	III	
Raw material				
A	2	2	4	12
B	1	4	4	20
Profit	2	5	8	

- (1) List and solve the linear programming model by simplex method, calculate the maximum total profit, and its corresponding production plan **(20 pt)**
- (2) Write the optimal basis for a linear programming problem and its inverse matrix **(15 pt)**
- (3) Write down its dual problem and the solution of dual problem **(15 pt)**
- (4) If the price of material A in the market is I , in order to obtain higher profits, should the factory purchase material A to expand its production scale? Why? **(10 pt)**
- (5) In what range does the profit of product II change and the optimal solution remains the same? Why? **(10 pt)**
- (6) If the usage of equipment is considered, assuming that the unit cost of three products I, II, and III are 4, 4, and 8 units respectively, and the total number of equipment hours is 30, then does the optimal solution change? Why? **(10 pt)**

Tip:

- a) If the original linear programming model is listed incorrectly, this question will be **directly** judged as **0 points**, so please double check whether your LP model is correct.
- b) The reason is worth 5 points, please explain the reason in as much detailed as possible

2. Illustrate the following statement **in detail** **(20 pt)**

In standard linear programming problem, suppose there is only one negative cost coefficient c_i . In simplex method, if the current basic feasible solution is non-degenerate, the entering variable will always be a basic variable in the rest procedures.