**Practice Question 3. Analytical Models in DSS**

A company that assembles electronic alarm systems requires three component parts: *C1, C2,* and *C3*. In-house production costs are estimated to be $15 per unit for part *C1*, $18 per unit for part *C2*, and $ 20 per unit for part *C3*. It requires 0.16 hours of machining time and 0.1 hours of finishing time to produce to each unit of part *C1* in-house; 0.3 hours of machining time and 0.2 hours of finishing time to produce to each unit of part *C2* in-house; and 0.25 hours of machining time and 0.3 hours of finishing time to produce to each unit of part *C3* in-house.

Because of contractual obligations the company needs 6,000 units each of parts *C1* , *C2*, and *C3* in the upcoming week. It has only 3000 hours of machining time and 2400 hours of finishing time available over this period. Since its limited production capacity prevents it from satisfying its entire demand for these parts through in-house production alone, the company also needs to purchase some quantities of these parts from external suppliers.

Two external suppliers are available – *Supplier A* and *Supplier B*. *Supplier A* can supply at most 1000 units of *C1* at a cost of $16 per unit, at most 1500 units of *C2* at a cost of $20 per unit, and at most 1000 units of *C3* at a cost of $24 per unit. *Supplier B* can supply at most 1200 units of *C1* at a cost of $18 per unit, at most 2000 units of *C2* at a cost of $22 per unit, and at most 1000 units of *C3* at a cost of $23 per unit.

For your convenience, the information presented above is summarized in the table below.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Cost per unit** | | | **Quantity** | **Capacity (units)** | | **Hours required per unit** | |
| **In-house** | **Supplier A** | **Supplier B** | **Required** | **Supplier A** | **Supplier B** | **Machining** | **Finishing** |
| **C1** | $ 15 | $ 16 | $ 18 | 6000 | 1000 | 1200 | 0.16 | 0.10 |
| **C2** | $ 18 | $ 20 | $ 22 | 6000 | 1500 | 2000 | 0.30 | 0.20 |
| **C3** | $ 20 | $ 24 | $ 23 | 6000 | 1000 | 1000 | 0.25 | 0.30 |
|  |  |  |  |  |  |  | **Available (hours)** | |
|  |  |  |  |  |  |  | **Machining** | **Finishing** |
|  |  |  |  |  |  |  | 3000 | 2400 |

The company uses a decision support system to determine the optimal production and purchase plan for parts *C1*, *C2*, and *C3* so as to meet their needs (contractual obligations in the upcoming week) at minimum cost. It also uses the decision support system to perform sensitivity analysis.

1. What is the minimum cost attainable under the optimal plan?

The company has located a third supplier (*New-Supplier*) who can supply at most 100 units of part *C1* in the upcoming week, but the purchase price is subject to negotiations. What is the maximum price that the company should be willing to pay *New-Supplier* for each unit of *C1*? Justify your answer. Assume that all demands, prices, and availability of resources remain unchanged.