## Answer on Question \#47102 - Math - Algorithms | Quantitative Methods

A book binder has one printing press, one binding machine and manuscripts of seven different books. The time required for performing printing and binding operations for different printing and binding operations for different books are shown below:

| Book | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :--- | ---: | :--- | :--- | :--- | :--- | :--- | :--- |
| Printing Time (Days) | 20 | 90 | 80 | 20 | 120 | 15 | 65 |
| Binding Time (Days) | 25 | 60 | 75 | 30 | 90 | 35 | 50 |

Find the optimum sequence of processing of the jobs that minimises the total time required. Also compute the optimal time required.

## Solution

Step 1. Minimum time is 15 days on printing press $\left(M_{1}\right)$ for job 6 so it will be sequenced earlier as shown

| 6 |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step II. Now book 1 and 4 have the least time of 20 days on printing press $\left(M_{1}\right)$ so these two books will be sequenced as

| 6 | 1 | 4 |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step III. After eliminating job 6, 1 and 4 least time is for job 7 on binding machine ( $M_{2}$ ) so it will be placed last in the sequence.

| 6 | 1 | 4 |  |  |  | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step IV. Now book 2 has least time of 60 on $M_{2}$, hence it will be placed at the end.

| 6 | 1 | 4 |  |  | 2 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step V. Book 3 has the least time of 75 days on $M_{2}$ so it will be placed as below.

| 6 | 1 | 4 |  | 3 | 2 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step VI. Jobs 5 will be placed in the vacant place

| 6 | 1 | 4 | 5 | 3 | 2 | 7 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Step VII. Total processing time can be calculated as follow:

| Optimum <br> sequence <br> of jobs <br> (books) | Printing |  | Binding | Idle time <br> for |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  | In | Out | In | Out |  |


| 6 | 0 | 15 | 15 | 50 | 15 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 15 | 35 | 55 | 75 | - |
| 4 | 35 | 55 | 75 | 105 | - |
| 5 | 55 | 175 | 175 | 265 | 70 |
| 3 | 175 | 255 | 265 | 340 | - |
| 2 | 255 | 345 | 345 | 405 | 5 |
| 7 | 345 | 410 | 410 | 460 | 5 |

## Total idle time

Printing $=(460-410)=50$ days as the printing of last job (7) is finished on 410 days but binding finishes only after 460 days, so printing machine is idle for 50 days.

Binding $=15+70+5+5=95$ days

