GAP Problem (maximisation problem)

v(P) < v(LR) < v(LP)

Actual solution = 563

LP estimated = 568.64

Now,
Estimating the optimal after Lagrangian Relaxation:

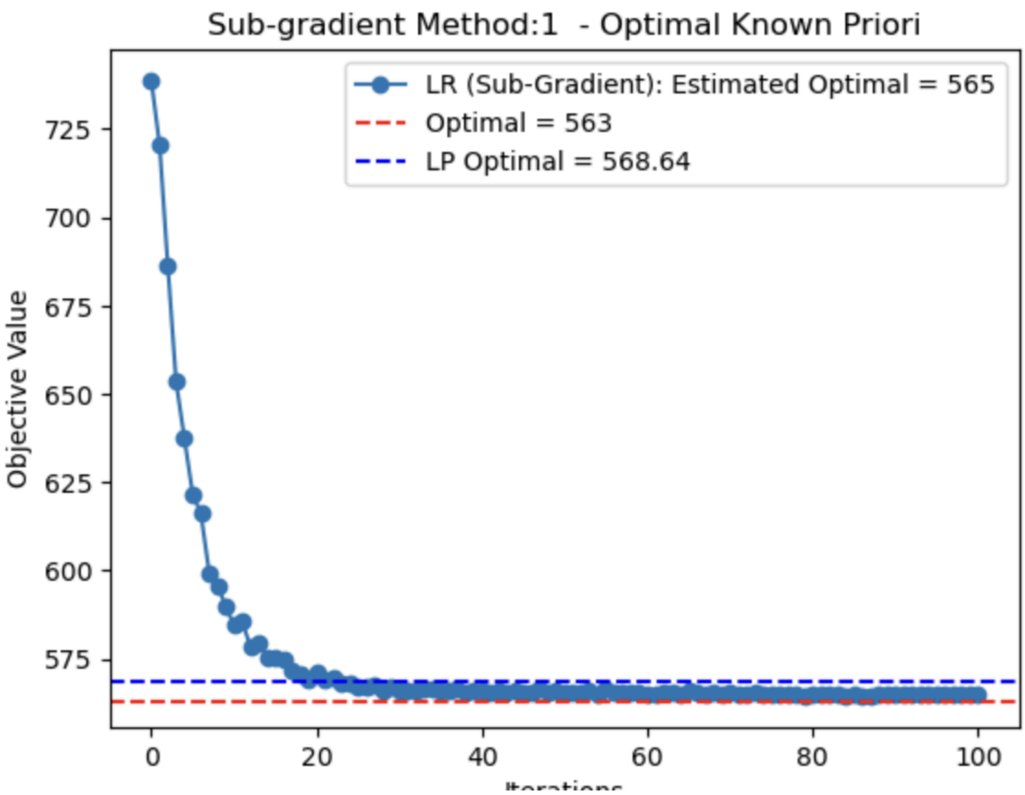
DUALISING MC CONSTRAINT (each job done my 1 machine)

1. **Subgradient Method**

1.1. Using known optimal

563	565	568.64

Final No. of MC constraints (out of 24) not satisfied = 7



Objective after 101 iterations = 565.0

Final No. of MC constraints (out of 24) not satisfied = 7
Thus, Langrangian solution is not feasible for Primal.

<u>1.2. Using random initial optimal (η^*) = 500</u>

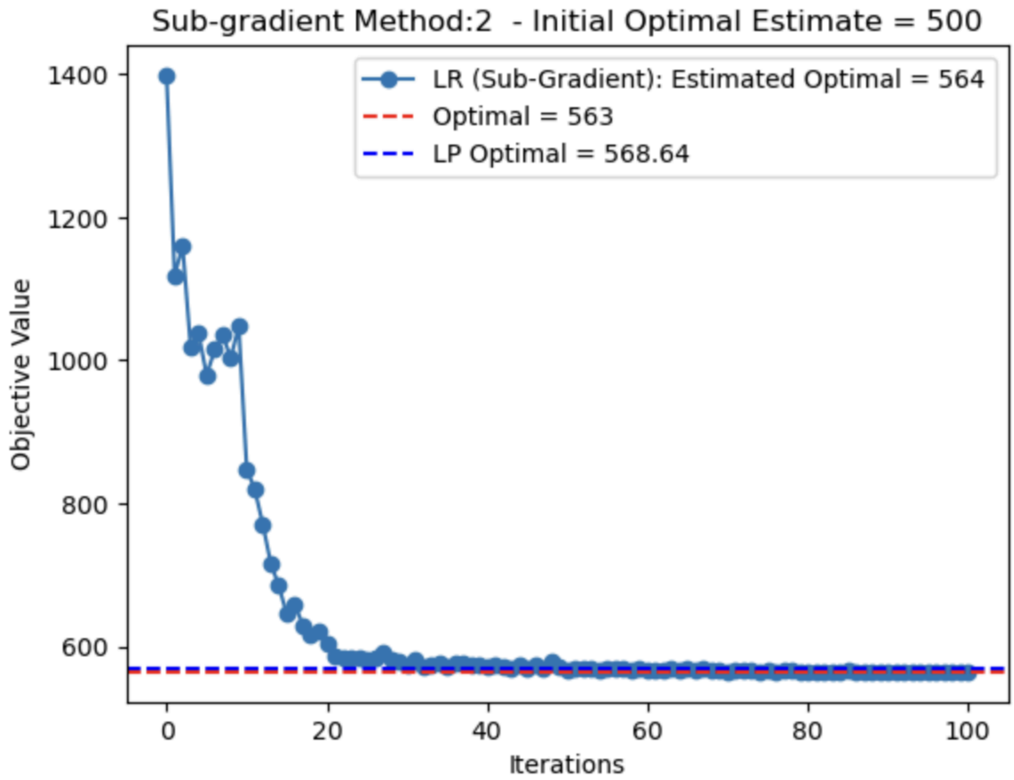
563	564.3404264376846	568.64

Final No. of MC constraints (out of 24) not satisfied = 2

In the code using epsilon to reduce eps* ($\eta^* - \eta^k$)
Where: η^k = optimal found at iteration k

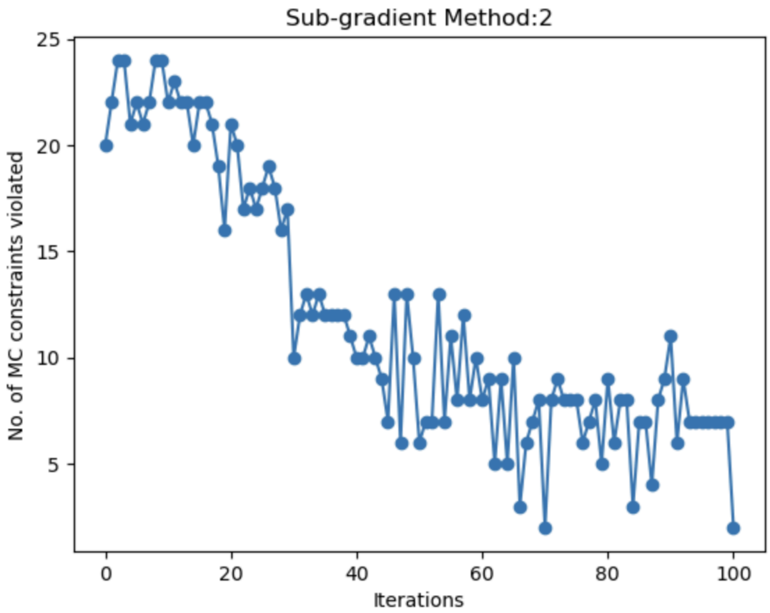
Where eps was reduced as:

```
if (it%10 == 0):        # Eps reduced after every 10 Iterations
    eps *= 0.6
```



Solution estimated = Objective after 1000 iterations = 564.3404264376846

Final No. of MC constraints (out of 24) not satisfied = 2
Thus, Langrangian solution is not feasible for Primal.



Heuristic to find solution (Lazy Heuristic)

Method: Fixing the variables for which solution got satisfied.
(Therefore, in objective and KP constraints, the variables which satisfied MC constrains got fixed.)
Then, Solving the lagrangian optimisation problem again with method 2:

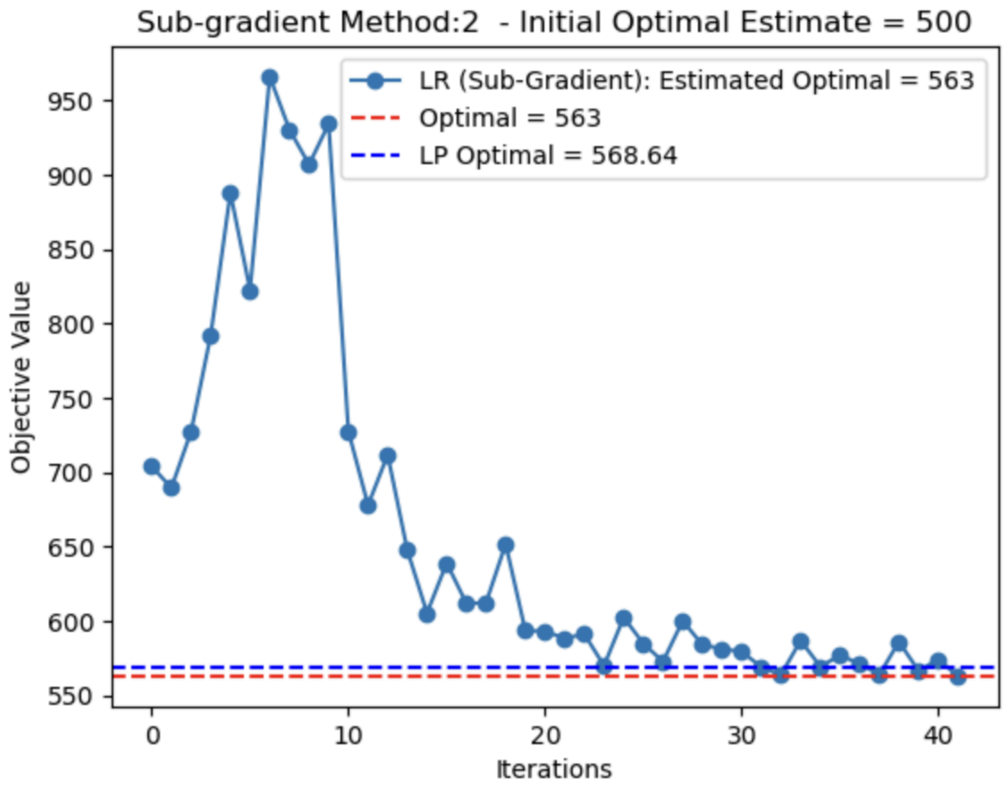
- **Using the condition of (Norm s == 0)**

Norm s being 0 implies, all the relaxed constraints have been satisfied.
We find, it converges after 42 iterations.

OUTPUT:
Objective after 42 (/100) iterations = 563.0

Final No. of MC constraints (out of 24) not satisfied = 0
Thus, Langrangian solution is feasible for Primal.

NOTES:
1. Again, the same initial estimate of 500 was used along with epsilon.
2. The plot is for second heuristic iteration



Finally, Plot for heuristic