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Nurse scheduling problem

1-idea in detail

The nurse scheduling problem (NSP) , is aiming to design a schedule for day-shift nurses

That minimize the total number of nurses employed

The problem is described as finding a schedule that both respects the constraints of the nurses and fulfills the objectives of the hospital. Conventionally, a nurse can work 1 shift

Per day , a nurse can work 3 consecutively and 4 days off

Goals of scheduling nurse problem (NSP):

- 1) Calculating the minimum number of nurses required
- 2) minimizing the number of nurses per day

NSP tries to:

- 1) distribute the workload fairly among nurses
- 2) reduce the costs
- 3) satisfy both the nurses' preferences and those of the hospital managers.

Sometimes these objectives conflict with each other. Nurses' preferences may not be completely satisfied and hospital managers may be forced to pay some penalties. Since hospital managers are often under pressure to control costs,

satisfy the nurses, and deliver high-quality services, developing an appropriate nurse scheduling can balance these pressures and use the nurses more effectively.

2-Similar app

App: ScheduleAnywhere

Platforms : Web/Mobile app

App Link: <https://www.getapp.com/hr-employee-managementsoftware/a/scheduleanywhere/>

in this app:

-Users can schedule and assign shifts and time off, with the ability to schedule multiple employees "nurses" at once .

-Staffing requirements can be entered into schedules to give users insight into whether a particular department, position, or shift is over- or under-staffed.

-The number of hours and staff members scheduled is automatically tracked, enabling users to monitor and control overtime.

3-Main functionalities:

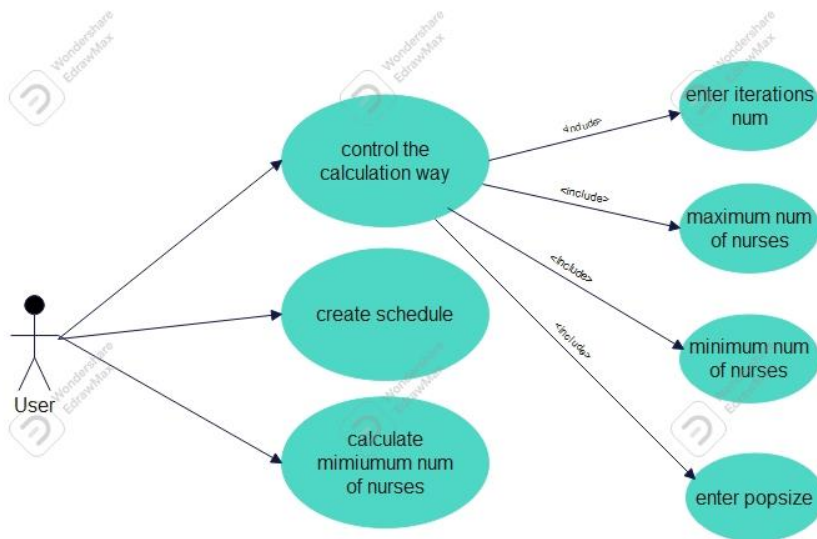
-System Functional req:

- System must be able to view number of nurses each day
- System must be able to calculate the minimum number of nurses required

-System Non-Functional req :

- Each nurse has 1 shift/day
- Each nurse has only 4 day-off /week
- The user can control the calculation way

Usecase diagram:



4-Literature review(5 Resources)

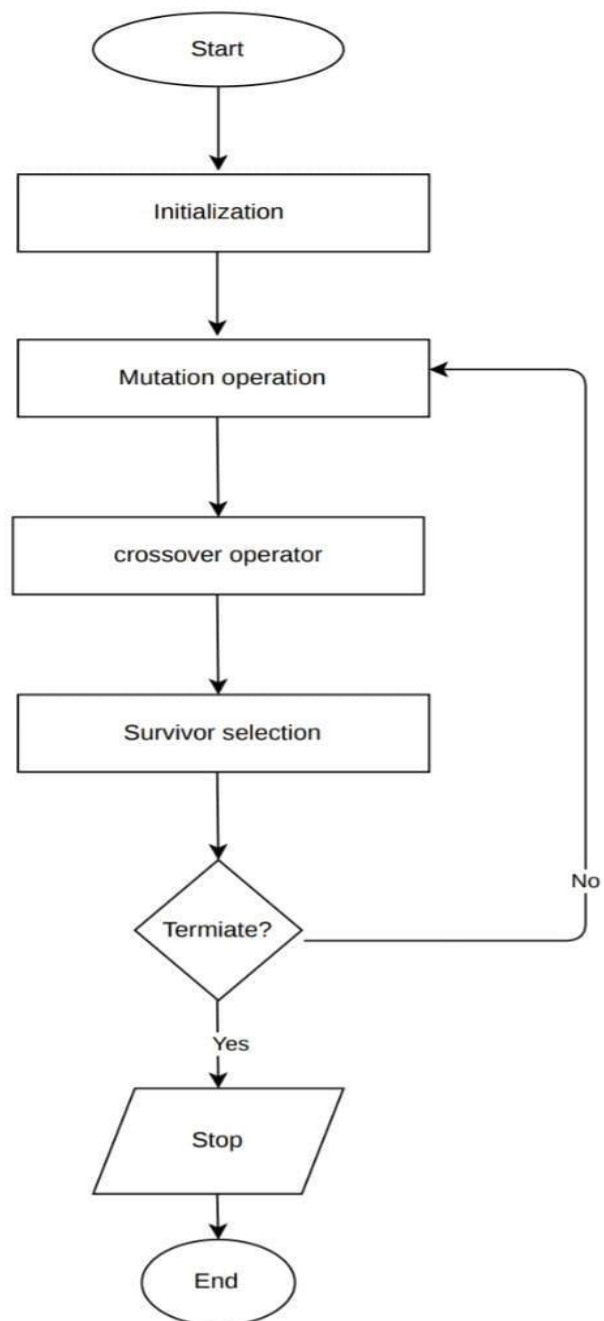
Link :

- 1- http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S222478902012000300008
- 2- <https://www.hindawi.com/journals/mpe/2014/246543/>
- 3- https://en.wikipedia.org/wiki/Nurse_scheduling_problem
- 4- https://silo.tips/queue/optimization-of-nurse-scheduling-problem-with-a-two-stagemathematical-programmi?&queue_id=-1&v=1671288167&u=MTAyLjE5MS4yMiguNDk= 5-
<https://www.rasmussen.edu/degrees/nursing/blog/working-12-hour-shifts/>

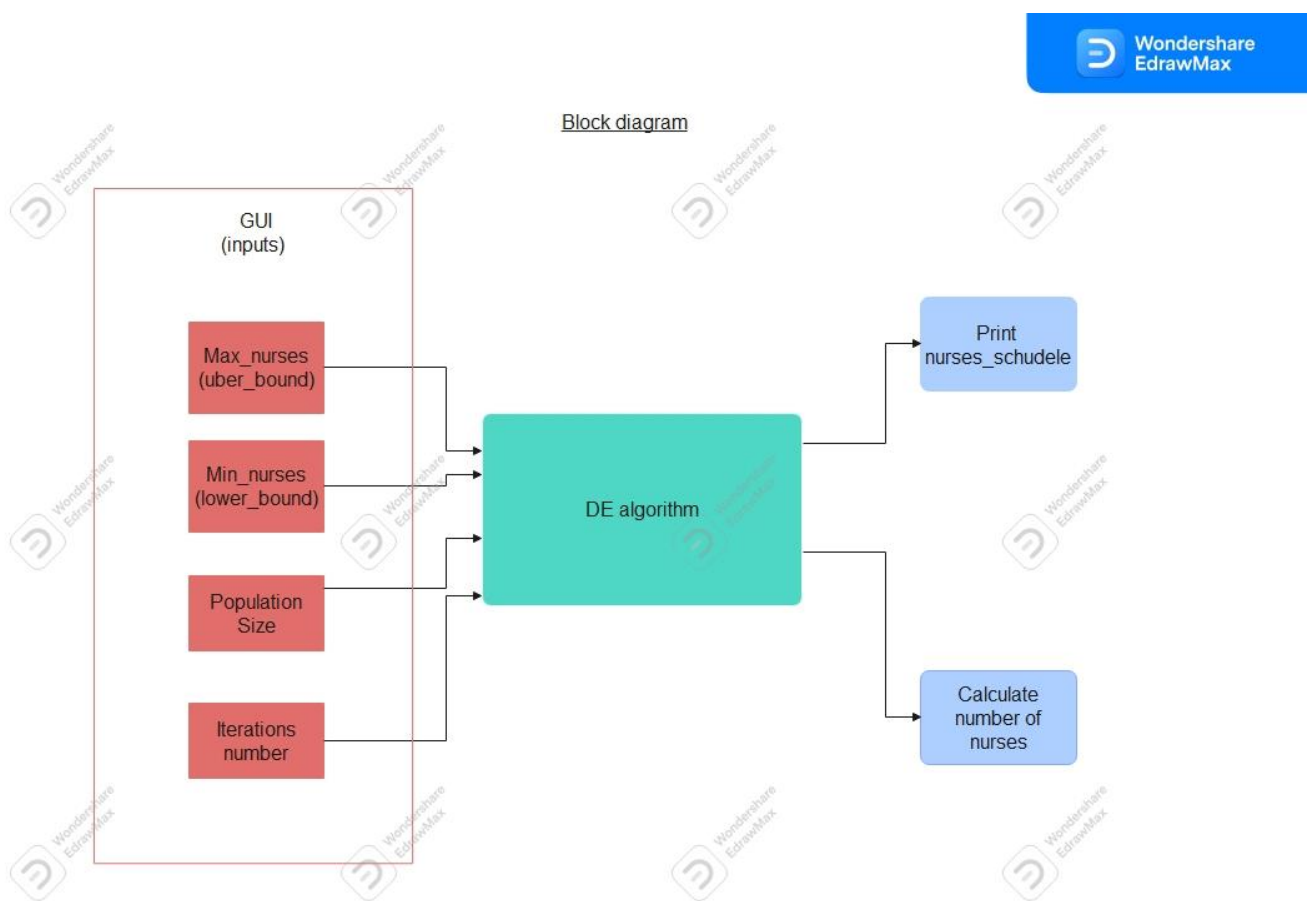
Resource:



5- a)Flow hart describe algorithm

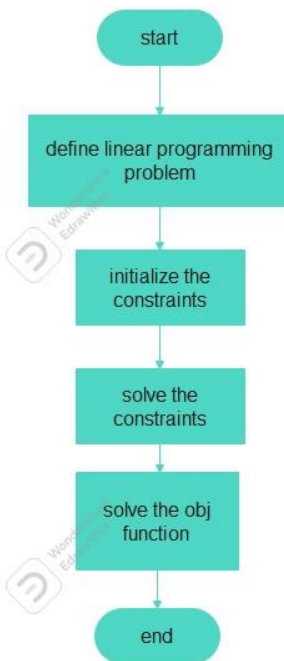


b)Block diagram :



b)linear programing:

Linear programming



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-Advantage of nurse schedule

- 1- Flexible workdays
- 2- Fewer days to commute
- 3- Steady workflow
- 4- Weekdays off

-Disadvantage of nurse schedule

- 1- Long days: Sometimes shifts can turn into 16-hour days to meet patient needs.
- 2- No downtime while on shift: As nurses move between patients and chart all necessary information, there might be few chances to stop and take a break.
- 3- Harder to focus on your own health: Fatigue and physical exertion

2 Differential Evolution algorithm (DE-1) for minimization problem.:

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Procedure DE

Initialisation:

 Initialise initial population

For counter=1 to **max-iteration**:

For each solution in the population:

 Create a mutant matrix for each solution in the current population.

 Apply crossover operator and select elements of a solution.

 Apply feasibility check procedure for generated solutions in the previous step

End for

 Apply improvement procedure on the generated new solutions.

 Apply feasibility check procedure on the outputs of improvement procedure.

 Update number of nurses.

End for

Return number of nurses.

End DE

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