# 1 GRASP

- Input: $n \in N$, $h \in H$, minHours, maxHours, maxConsec, maxPresence
- Output: $W_{n,h}$,cost
- Procedure Construct

```
Initialize $W_{n,h} = 0$, $\forall n \in N, \forall h \in H$
for n in N
    H'=H
    ComputeGreedyCost(H')
    order1=sort(H','gc',asc)
    $min_{gc}$=the gc of of first(order1), $max_{gc}$=the gc of the last(order1)
    RCL $\leq$ $min_{gc}$+$\alpha$($max_{gc}$-$min_{gc}$)
    Randomly select an hour (h) from RCL, set $W_{n,h}$=1, remove(h)
    if complete(All $gc_h \geq 0$)  then break
    while k$\leq$max
        get the $h_{start}$ & $h_{end}$ of the working hours
        if Sum($w_{n,h}$) $\geq$min & $h_{end}$-$h_{start}$+1==maxPresence  then break
        order2=sort(H'[$h_{start}$-2, $h_{end}+2$],'gc',asc)
        if satisfy maxConsec
            h'=first(order2), set $W_{n,h'}$=1
        remove(h')
cost = getNumberofWorkingNurses
return $W_{n,h}$, cost
End Construct
```

- Procedure Local Search

```
$W''_{n,h}$=$W_{n,h}$
for n $\in$ NumberofWorkingNurse
$W'_{n,h}$=$W''_{n,h}$
    for n' $\in$ NumberofWorkingNurse\n
        Set $W'_{n,h}$=0,$W'_{n',h}$=0, $\forall h \in H$
        if SumofWorkinghours($\forall h \in H$) $\leq$ $Demand_h$-2  then continue
        elseif CanNotGenerateFeasibleW'  then continue
        Generate a Feasible $W'_{n,h}$
        $W''_{n',h}$=$W'_{n',h}$, $W''_{n,h}$=$W'_{n,h}$
        cost-=1
```

```
            break
        Update NumberofWorkingNurse
    $W_{n,h}$=$W''_{n,h}$
    return $W_{n,h}$, cost
End Local Search
```

- The function of greedy cost is as below:

$$\mathrm{gc}=Current_h\text{-}Demand_h$$

## 2 BRKGA

The length of chromosome: N*H

- Input: population, data
- Procedure Decoder

```
for each chromosome in population
    for each gene in chromosome
        if gene $\geq$ 0.5 then sol=1
        else sol=0
    if satisfy min/max/maxConsec/MaxPresence/CannotRest2hours
        solution=append(sol)
        fitness=the Number of Rows with any gene $\geq$ 0.5
    else solution=null, fitness=$\infty$
Return (chromosome,solution, fitness)
End decoder
```