Kidney-Inspired Algorithm

Kidney process in Human body

There are four steps in urine formation

Filtration

Involves the transfer of solutes and water from the blood to the tubules in the kidneys.

Reabsorption

the movement of useful water and solutes from the tubules back into the blood

Secretion

the tubules continue to secrete extra and harmful substances into the tubular. The end result of the above three steps leaves the body via urine in Fourth step **Excretion**.

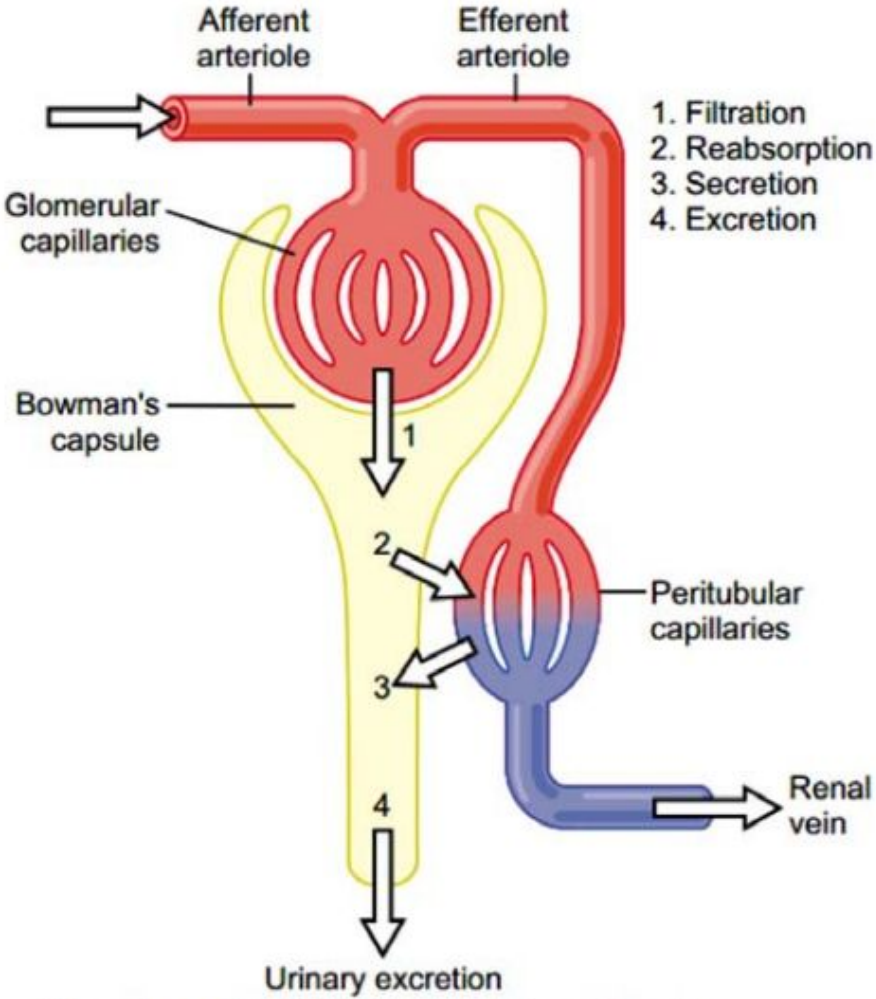
The 4 steps

1 - The KA starts with an initial population of water and solutes particles (solutions).

2 - At each iteration, the solutes are filtered depending on a filtration rate that is calculated based on mean of objective functions (MOH of all solutes).

3 - The filtered solutes are moved to filtered blood (FB) and the rest are transferred to waste (W).

4 - A solute allocated to W is reabsorbed if it can become part of FB after applying the reabsorption operator, otherwise it is excreted from W. In addition, a solution in FB is secreted if it is not better than the worst solution in FB. After treating all the solutions in the population, all the solutions are ranked, W and FB are merged to be the new population and the filtration rate is updated.

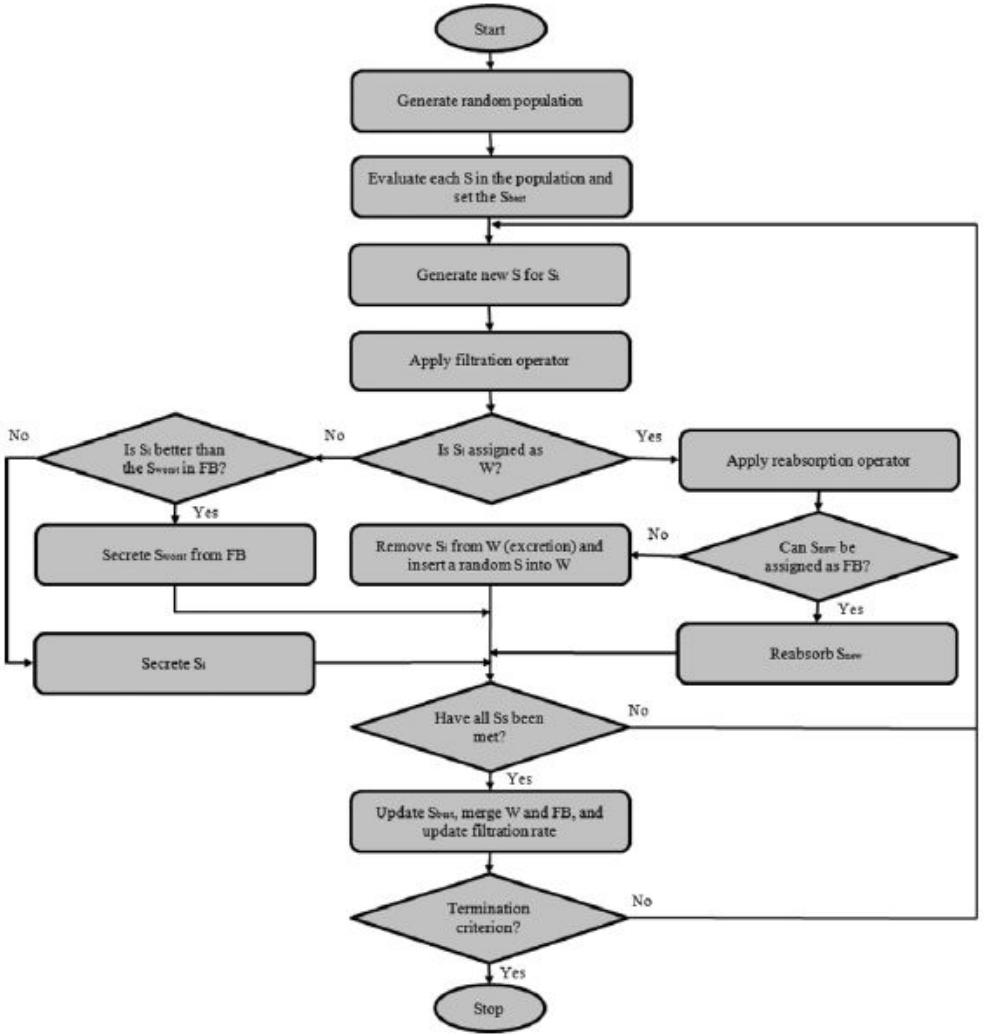


Excretion = Filtration – Reabsorption + Secretion

Kidney-Inspired Algorithm - (Back to Computer Science :D)

```
set the population
evaluate the solute in the population
set the best solute, S_best
set filtration rate, fr, Eq. 2
set waste, W
set filtered blood, FB
set number of iterations, numofite
do while (ite<numofite)
        for all s_i
                generate new S_i, Eq. 1
                check the S_i using fr
                if S_i assigned to W
                        apply reabsorption and generate S_new, Eq. 1
                        if reabsorption is not satisfied (S_new cannot be a part of FB)
                                remove S_i from W (excretion)
                                insert a random S into W to replace S_i


                        endif
                        S_new is reabsorbed
                else
                        if it is better than the S_worst in FB
                                S_worst is secreted
                        else
                                S_i is secreted
                        endif
                endif
        endfor
        rank the Ss from FB and update the S_best
        merge W and FB
        update filtration rate, Eq. 2
end while
return S_best
```


Start
Generate random population
Evaluate each S in the population and set the Sbest
Generate new S for Si
Apply filtration operator
Is Si assigned as W?
No
Yes
Apply reabsorption operator
Is Si better than the Sworst in FB?
No
Yes
Secrete Sworst from FB
Remove Si from W (excretion) and insert a random S into W
Can Sbest be assigned as FB?
No
Yes
Secrete Si
Reabsorb Sbest
Have all Ss been met?
No
Yes
Update Sbest, merge W and FB, and update filtration rate
Termination criterion?
No
Yes
Stop