|  |  |  |  |
| --- | --- | --- | --- |
| State | Energy | Multiplicity | Weight |
| Promoter OFF |  |  |  |
| Promoter ON |  |  |  |

1a)

1b/c)

We rewrite the weights using the given approximations

Promoter OFF Multiplicity:

Promoter ON Multiplicity:

So we have the probability:

2 in jupyter notebook

3a)

|  |  |  |  |
| --- | --- | --- | --- |
| State | Energy | Multiplicity | Re-Normalized Weight |
| Promoter OFF  Repressor ON-Non-specifically |  |  |  |
| Promoter OFF  Repressor ON-Specifically |  |  |  |
| Promoter ON  Repressor ON-Non-Specifically |  |  |  |

3b)

We use the re-normalized weight from above to calculate the probabilities of the states.

3c) In jupyter notebook

3d)

we take as the steady state:

Thus we have

So substituting from 3b we get:

And from equation 6 we have:

3e)

We observe from earlier that the Boltzmann weight for the promoter is insignificant and we drop it from the equation:

3f) on notebook

4a)

|  |  |  |  |
| --- | --- | --- | --- |
| State | Energy | Multiplicity | Re-Normalized Weight |
| Empty State |  |  |  |
| Promoter Filled |  |  |  |
| Activator Filled |  |  |  |
| Both Filled |  |  |  |

4b)