Median-of-Median Algorithms with different Stopping Lengths
Chen Yuhao
NetId Yuhaoc2
Graduate Student

Q1.

Since we are given m longer part of the L-length bar, it is equivalent to m samples sampled uniformly from $[\frac{L}{2}, L]$.The smallest value in these m-longer samples are the 1st order statistics of these samples drawn from uniform distribution.

It can interpreted as that the m sticks falls on to the $[\frac{L}{2}, L]$ region, therefore, the region is dissembled into $\mathrm{m}+1$ sectors, the length of the $\mathrm{m}+1$ sectors should be uniformly distributed. Therefore, the shortest stick should fall in the sector closest to the starting point $\frac{L}{2}$, the sector length mean is $\frac{L}{2*(m+1)}$. Therefore, the mean length of the smallest of these m-many longer-pieces of candy stick is $\frac{L}{2}+\frac{L}{2*(m+1)}=\frac{m+2}{2(m+1)}L$.

Q2.

From Q1, we have found that the shortest length of the worst case array length is $\frac{m+2}{2(m+1)}L$. Therefore, we will have the following formula for the execute time if the array size is n:

$$\mathrm{A(n)} \leq \mathrm{c}*(\mathrm{n}-1)+\mathrm{A}\left(\frac{m+2}{2(m+1)}n\right) \leq \mathrm{c}*\mathrm{n}+\mathrm{A}(\frac{m+2}{2(m+1)}n)$$

Following the previous process:

$$\mathrm{A(n)} \leq \frac{2(m+1)}{m+2}\mathrm{c}*\mathrm{n}$$