<http://goldberg.berkeley.edu/pubs/fogel-CASE07_0166_FI.pdf>

## One-dimension beacon navigation problem

Simplifications:

1. In one dimension case we can reduce the problem by using linear segments:



1. We could discard dealing with partition size and concentrate only on the total number of distinctly identifiable partitions (DIPs) because by adjusting the beacon strength (segment sizes) we can get DIPs of equal size.

Theorem:

Given *n* beacons in one dimension the best solution will have *2n* distinctly identifiable partitions (DIP).

Proof:

We will prove this by induction on the number of beacons.

1. Basis: given one beacon it is obvious that the maximal number of DIPs is 2.
2. Let’s assume that for given *n* beacons we have *2n* DIPs and now we’ll check for *n+1* beacons:  
   * Using the *n* beacons we get the *2n* DIP – by the assumption.

b

a

c

* + Let’s select 2 adjacent DIPs (*A* and *B*):
  + Let’s place the new (n+1) segment *C* such that it will intersect both *A* and *B* DIPs starting from the middle of *A* and ending at the middle of *B*.
  + The first part of *A* (not intersecting with *C*) is described by the same beacons as before; the same applies to the last part of B.
  + The part of A which intersects with C is described by the **new** set of beacons (the “old” *A* set + *C* beacon) which gives us 1 new DIP.
  + The same is valid for *B* from the symmetry reasons, which gives us another **new** DIP.
  + Now we used *n+1* beacons and get *2n+2* DIPs.

Our solution for one-dimension:



## Two-dimension beacon navigation problem

Benchmark table:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **File name** | **N=4** | | **N=8** | | **N=16** | | **N=32** | | **N=64** | |
| **D** | **T** | **D** | **T** | **D** | **T** | **D** | **T** | **D** | **T** |
| bm\_grid10000\_.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_grid1000\_.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_grid100\_.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_10000\_0.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_10000\_1.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_10000\_2.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_10000\_3.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_1000\_0.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_1000\_1.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_1000\_2.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_1000\_3.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_100\_0.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_100\_1.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_100\_2.txt |  |  |  |  |  |  |  |  |  |  |
| bm\_random\_100\_3.txt |  |  |  |  |  |  |  |  |  |  |