<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 (DIP).

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:

