

AE4580 Introduction to Avionics Integration

Spring 2004 Homework #1

Due: Friday January 16, 2004 at 2:05pm (beginning of class) or before

1. Dead reckoning practice: Problem 2.2 in Kayton & Fried  
(note: definition of Gaussian radius is in the text).
2. Problem 2.3 in Kayton & Fried. Warning: the answer in the book isn't correct.
3. You are navigating in a small area, where it is sufficiently accurate to neglect the curvature of the Earth. The local convention is to specify locations in coordinates  $(x,y)$ , where  $x$  is distance North from an agreed-upon landmark, and  $y$  is the distance East. (hint: including a figure or at least a sketch can be very helpful in catching errors)
  - (a) You are on a bearing of 0 degrees (North) from grid location (500m,100m) and on a bearing of 90 degrees (East) from grid location (900m,-350m). Where are you?
  - (b) You are 100m from a point located at grid location (500m,100m) and 200m from a point located at grid location (700m,150m). Where are you?
  - (c) You are 150m from a point located at grid location (500m,100m), and on a bearing of 142 degrees (Southeast) from a point located at (1000,-200m). Where are you?
  - (d) A signal from grid location (500m,100m) arrives 500ns ( $1 \text{ ns} = 1 \text{ billionth of a second}$ ) faster than a signal from location (100m,250m), and at (500m,100m) 400ns faster than a signal from location (-250m,-250m). Take the speed of light to be 0.3m/ns. Where are you?
4. You have become the Secretary of Transportation of a country that is just now building their first radio navigation infrastructure for aviation use. Due to corruption in the government, you are only allowed to utilize a particular brand of navigation aid (because the company that makes them knows the right people...), which provides only a direction from the station, i.e. bearing. The system can reliably determine direction within 0.4 degrees. Your airspace is such that collisions are prevented if aircraft always remain within 4nm laterally (left/right) of their desired position en-route (they obviously need more accuracy than this near airports to land, but this is handled by another system).
  - (a) What is your plan/strategy for locating them to minimize cost to the government and (b) what is the minimum equipment the government will need to require every aircraft in your airspace to have? Provide a detailed justification of your answer for your testimony before Congress (one or two paragraphs and diagrams).