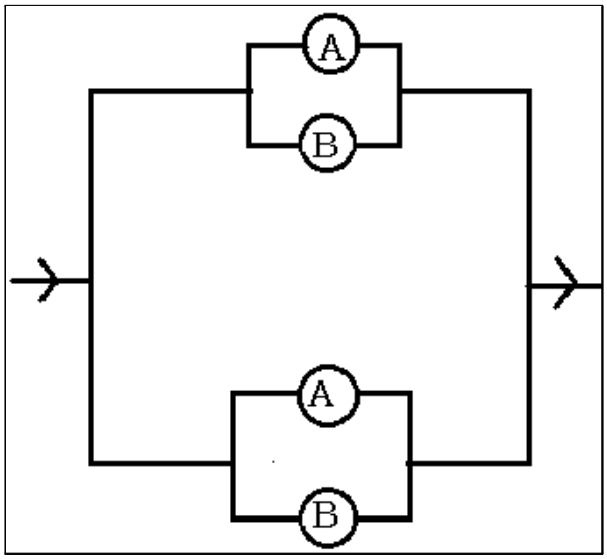
Introduction to Probability
Worksheet #2

Professor Broughton

Name:_____ Box #:_____

1. System Reliability

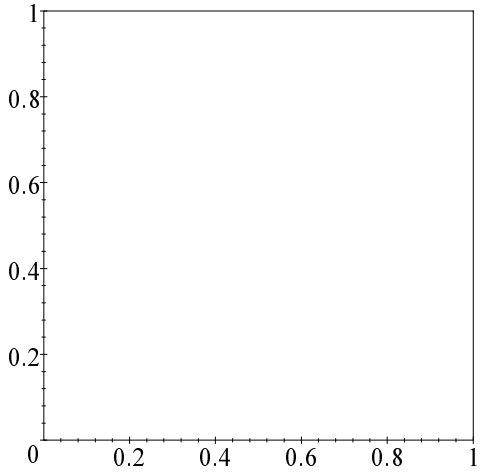
1. After having looked series and parallel systems, let's compute a more complex system reliability function. In the diagram below the components A and B have reliability p and q respectively



1.a Determine the system reliability function $R(p, q)$ as a polynomial in p and q.

2.a The situation is the same as in question 1. Determine the relation between p and q that will guarantee 99% reliability.

2.b Draw a picture of the corresponding curve in the p q plane



3 Suppose that the cost functions for components A and B are given by:

$$A \quad : \quad f(p) = 10 + \frac{5}{(1-p)}$$
$$B \quad : \quad g(q) = 25 + \frac{8}{(1-q)}$$

What choices for p and q will give a minimum cost system with a 99% reliability?

4. Six cameras are equally spaced around the perimeter of a circular chamber. Each camera is focused on the center of the room, but can take a wide angle photo of 130 degrees. The system is declared functional if enough cameras are working so that the entire chamber can be captured on film by the working cameras. If the reliability of a camera is p, determine the system reliability.

5. Consider the system of four working computers given in worksheet 1 Assume that all the links are independent, and that the economic lifetime of the entire system is two years. Assume that probability of failure during the economic lifetime is q so that the reliability is $p = 1 - q$. The links are not replaced if they fail.

5.a Pick a specific configuration in which there are exactly n functioning links at the end of the economic lifetime. What is the probability that this will happen, in terms of p and q and in terms of p alone.

5.b Write out the system reliability function as a function of p and q and as a function of $R(p)$ of p alone.

5.c Graph $R(p)$ and determine what value of p will guarantee a system reliability

of 99.999%.