HW3: Paper from 2010

i) *Reference*:

Tsong Yueh Chen, Fei-Ching Kuo, Robert G. Merkel, T.H. Tse
Adaptive Random Testing: The ART of test case diversity
Journals of System and Software Volume 83 Issue 1, January 2010

ii) *Keywords*:

1) **Failure patterns:** Many program faults result in failures in contiguous areas of the input domain. This is known as failure patterns.
2) **Adaptive Random Testing (ART):** Random testing methods which use the concept of *failure patterns* to serve as guides or filters randomly generated candidates to take advantage of the presence of such patterns.
3) **F-measure:** Average of the number of tests required to detect the first failure.
4) **Restricted Random Testing (RRT):** A testing method which involves "exclusion zones" around test cases such that a random generated test case is used only if it lies outside all exclusion zones; otherwise the process is repeated.

iii) Paper Contents:

1) **Motivational Statements**: Software testing is a slow, labor-intensive and an imperfect process. Thus, there is a major need for deriving methods that perform testing more effectively and at a lower cost. This paper focuses on efforts to regulate random testing to improve the failure-detection effectiveness of random testing.
2) **Related Work**: Ammann and Knight formulated a theoretical model based on numerical analysis, to determine the distribution of failures caused by various faults. They concluded that the faults resulted in "locally continuous" failure regions which supports authors' hypothesis. Chen formulated a similar algorithm which performed ART by partitioning the input domain into equal domains and allocating test cases evenly to these domains. These along with various other methods, have a similar range of failure-detection efficiency with a maximum of 50%.
3) **Hypotheses**: (i) ART can be used as a replacement for Random Testing to serve as a baseline method for test case selection.
   (ii) Another useful application of AR sequences is for regression testing.
   (iii) It further encourages research into geometry and distribution of failure patterns that can hep in designing appropriate algorithms to find the next test to execute.
4) **Future work**: ART can employ more rigorous and scientific analysis of the relationships between the information available to the software tester and the effectiveness of families of testing strategies.

iv) Needs Improvement:

1) The authors have assumed a uniform sampling distribution for the operational profile. However, in practice, such a scenario is rare and the sample may be skewed as per the usage patterns of the software under consideration. The authors can also conduct research on the non-uniform sampling profiles and give the average of these two results as the effective result of their work.

2) The study assumes that the tester is aware of the failure pattern (size, shape and orientation off single failure region) and hence can make an educated guess about the and location of the failure. The F-measure is highly dependent on these factors and conclusively, the effectiveness of this algorithm is bound to decrease when the tester has no awareness of failure pattern.