CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S1416

Project Title

The Effect on Software Stability by Targeted and Random Function Removal

Abstract

Objectives/Goals

My objective was to understand how Linux Version 1.0 Kernel behaved under targeted and random removal, and to see whether Linux Version 1.0 Kernel behaved more like the SF or ER model.

Methods/Materials

The materials used in this project included a computer, Wolfram Mathematica, Linux SourceCode Version 1.0 Kernel, and Microsoft Excel. For targeted and random removal, the function call graph of Linux Version 1.0 Kernel was loaded onto Wolfram Mathematica.The duplicate function calls were deleted, and the largest SCC was found. For targeted removal, the most connected SCC function was removed until the software system disintegrated. For random removal, a random SCC functions was removed until the software system disintegrated. The results were then graphed on Microsoft Excel.

Results

Linux Version 1.0 Kernel disintegrated approximately 5.875 times faster with targeted function removal than random function removal. For targeted removal, the software system disintegrated when 0.125 of the largest Strongly Connected Component (SCC) original functions. On average, for random removal, the software system disintegrated when 0.734375 of the original number of SCC functions were removed. For targeted removal, the deviation was zero, and for random removal, the average deviation was 3.98. When compared to targeted and random removal graphs of SF and ER, Linux Version 1.0 Kernel's graph was more like the SF graph.

Conclusions/Discussion

My results supported my hypothesis. Linux Version 1.0 Kernel disintegrated faster with targeted removal than with random removal, and behaved more like the SF model than the ER model. Linux Version 1.0 Kernel, however, behaved more like an ER than expected. The results show that for a software system to be immune to random attacks (e.g. viruses and bugs), the software system should be modeled after the SF network model.

Summary Statement

Linux Version 1.0 Kernel's software stability disintegrates more with targeted than with random removal, and behaves more like the SF than the ER model.

Help Received

Was given article that inspired the project and was taught how to program in Wolfram Mathematica by mentor, Mr. Gene Ma