

Homework Number 3

Optional

1. A system exists which calculates student GPAs. Each quarter when grades are filed, the student grades will be entered by the grade entry process. This information is then passed on to a process "updateGPA" which will read the existing grades from the database and combine that data with the new grades to calculate an updated GPA. The updated GPA will then be sent to the process Determine honor roll, which is responsible for writing out the names of students who are on the honor roll to a file.
 - a. Based on this description, draw a data flow diagram for the system.
 - b. Write a data dictionary entry for the field holding a student's GPA.
 - c. What risks does this entry imply for the software?
2. A web system deployed on campus has a failure rate of 10^{-3} failures per hour. What is the likelihood that the system will continue operating without failure throughout the duration of exam week (Monday through Friday)? (Show all work, both assuming failure in each hour is independent and that it is dependent.)
3. Two processes are each normally distributed and have the same mean, which is unknown. Process A takes 15ms/operation, while process B takes 17 ms/operation. The sample standard deviation, averaged over both processes, is 2.5 ms.
 - a. If these means come from 5 samples for each process, can we say that the processes are significantly different? (At roughly what p-value?)
 - b. If these means come from 10 samples for each process, can we say that the processes are significantly different? (At roughly what p-value?)
 - c. If these means come from 100 samples for each process, can we say that the processes are significantly different? (At roughly what p-value?)
 - d. If we KNOW that the true standard deviation is 2 ms, what can we say about this process?

(Remaining problems to be covered on Tuesday)

4. A web server receives a request every 50ms and processes web requests every 8 ms. Using queuing theory,
 - a. What is the average response time for this system?
 - b. How large should the queue be if there is to be a less than .5% chance of the queue overflowing?
 - c. What would the waiting time be if the web server is modified to have 2 threads serving processes but nothing else changes?

5. The following shows an output from gprof. Which functions should be improved first if you are trying to improve the performance of the system?

```
% cumulative self self total
time seconds seconds calls ms/call ms/call name
50.4 0.59 0.59 1024 0.58 0.70 .fft [3]
37.6 1.03 0.44 1 440.00 1160.00 .main [1]
11.1 1.16 0.13 1024 0.13 0.13 .bit_reverse [4]
0.9 1.17 0.01
0.0 1.17 0.00 256 0.00 0.00 .__mcount [5]
0.0 1.17 0.00 256 0.00 0.00 .cos [6]
0.0 1.17 0.00 19 0.00 0.00 .sin [7]
0.0 1.17 0.00 19 0.00 0.00 .fwrite [8]
0.0 1.17 0.00 19 0.00 0.00 .memchr [9]
0.0 1.17 0.00 11 0.00 0.00 ._flsbuf [10]
0.0 1.17 0.00 8 0.00 0.00 .gettimeofday [11]
0.0 1.17 0.00 8 0.00 0.00 .pwr10 [12]
0.0 1.17 0.00 7 0.00 0.00 ._doprint [13]
0.0 1.17 0.00 7 0.00 0.00 .__xflsbuf [14]
0.0 1.17 0.00 7 0.00 0.00 ._xwrite [15]
0.0 1.17 0.00 7 0.00 0.00 .printf [16]
0.0 1.17 0.00 7 0.00 0.00 .write [17]
0.0 1.17 0.00 4 0.00 0.00 .__ld [18]
0.0 1.17 0.00 4 0.00 0.00 .__nl_langinfo_std [19]
0.0 1.17 0.00 4 0.00 0.00 .cvt [20]
0.0 1.17 0.00 4 0.00 0.00 .cvtloop [21]
0.0 1.17 0.00 4 0.00 0.00 .ecvt [22]
0.0 1.17 0.00 4 0.00 0.00 .mf2x1 [23]
0.0 1.17 0.00 4 0.00 0.00 .nl_langinfo [24]
0.0 1.17 0.00 3 0.00 0.00 .splay [25]
0.0 1.17 0.00 2 0.00 0.00 .free [26]
0.0 1.17 0.00 2 0.00 0.00 .free_y [27]
0.0 1.17 0.00 1 0.00 0.00 .__ioctl [28]
0.0 1.17 0.00 1 0.00 0.00 .__findbuf [29]
0.0 1.17 0.00 1 0.00 0.00 ._wrtchk [30]
0.0 1.17 0.00 1 0.00 0.00 .atoi [31]
0.0 1.17 0.00 1 0.00 0.00 .catopen [32]
0.0 1.17 0.00 1 0.00 0.00 .exit [33]
0.0 1.17 0.00 1 0.00 0.00 .ioctl [34]
0.0 1.17 0.00 1 0.00 0.00 .isatty [35]
0.0 1.17 0.00 1 0.00 0.00 .moncontrol [36]
0.0 1.17 0.00 1 0.00 0.00 .monitor [37]
0.0 1.17 0.00 1 0.00 0.00 .saved_category_name [38]
0.0 1.17 0.00 1 0.00 0.00 .setlocale [39]
```