Logo, company name

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**COMP9334 - Capacity Planning of Computer Systems and Networks**

**T1 2022**

**Project**

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# Simulation Program

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Shell script “run\_test.sh” will execute the main.py with the file number and generate corresponding mrt\_\*.txt and dep\_\*.txt.

The input files are located at “config” directory and the output file the generate by the main.py are located at “output” directory.

All the logs that created by the simulation and scripts are located at the folder “support\_material”.

## Inter-arrival Probability Distribution (Random Mode)

The a1k is exponentially distributed with parameter λ. The a1k is uniformly distributed in the interval of [a2l, a2u] that is provided on the test sample. The inter-arrival time of jobs is the product of a1k and a2k resulting in exponential distribution. In my code (screenshot), I used two modules. One is the random.expovariate and the other one is random.uniform.

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Firstly, I write a code on the main.py to generate an inter-arrival time log when running a random mode sample test (shown below) and the log will save at the support\_material.

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Seondly, to run draw.py in support\_material will generate corresponding plot to show the generated inter-arrival time to support my distribution is correct.

Chart, histogram

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| --- | --- | --- | --- |
|  | **Sample Test 5** | **Sample Test 6** | **Sample Test 7** |
| Mode | Random | Random | Random |
| a2k (interval) | [0.6, 0.8] | [0.8, 1.020] | [0.9, 1.1] |
| Lambda | 1.4 | 1.4 | 1.2 |
| Number of Job (Approximately) | 4034 | 6097 | 7278 |
| End time | 2000 | 4000 | 6000 |
| Bin | 50 | 50 | 50 |
| Actual Mean value | 0.4958 | 0.6561 | 0.8245 |
| Expected Value (1/ λ) | 0.7142 | 0.7143 | 0.8333 |

According to the graphs above, all three samples are exponentially distributed. But the end time of Simple 5 is relatively low so the number of jobs is much less than in samples 6 and 7. So the expected value and actual mean value are quite different. But overall, those three random samples are exponentially distributed. The sample 7’s expected value and actual Mean Value almost the same.

## Probability Distribution of the number of Sub-Job (Random Mode)

The number of sub-jobs that generate per arrival is basic on the probability sequence on interarrival\_\*.txt. The module that I use is “random.choice()” which will pick a number of sub-jobs base on the provided weight.

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The log file of the service time of each sub-job will be generated with that name as “sub\_job\_service\_time\_\*.txt” and stored in the support\_material directory. After that run draw.py will generate the bar diagram to prove the probability distribution is correct.

Chart, bar chart

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| --- | --- | --- | --- |
|  | **Sample 5** | **Sample 6** | **Sample 7** |
| Sub job NO | [1654,1170, 823, 197, 199] | [1868, 1777, 1239, 656, 307, 310] | [2181, 1796, 1373, 1077, 400, 339] |
| Total Job arrival | 4046 | 6158 | 7167 |
| Actual Percentage | [0.4088, 0.2892, 0.2034, 0.0487, 0.0492] | [0.3033, 0.2886, 0.2012, 0.1065, 0.0499, 0.0503] | [0.3043, 0.2506, 0.1916, 0.1503, 0.0558, 0.0473] |
| Excepted Percentage | [0.4, 0.3, 0.2, 0.05, 0.05] | [0.3, 0.3, 0.2, 0.1, 0.05, 0.05] | [0.3, 0.25, 0.2, 0.15, 0.05, 0.05] |

According to the Graph and the table above, the actual percentage of sub-job that are created per arrival is very close to the excepted Percentage. By comparing samples 5 and 7. The variable of sample 5 can be up to 0.02 but the variance of Sample 7 is lower than 0.01, this is because the sample of Sample 7 is a lot more than sample 5 (7167>4046). The number of sample increase and the variance of the actual percentage and the excepted percentage will be lower.

We can conclude that the number of sub-jobs generated per arrival is correct and match the probability distribution provided by the sample.