

**Lab Report**

**实验报告**

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| **Course**: | Class Libraries and Data Structures |
| **Semester**: | 1st semester of the academic year **2024-2025** |
| **Major**: | Software Engineering |
| **Class**: | 2023 |
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**School of Computer and Information Science**

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| Name | | Queue and Simulation  队列和仿真 | | | |
| Date | | Nov，2024 | Type | | ☑Confirmatory （验证确认型）  ☑Design（设计型）  🗆Comprehensive（综合型） |
| 1. **Objective & Requirements（实验目的）**    1. Understand the concept of container adapter; Know the implementation the queue container adapter in the STL   理解容器适配器的概念；了解STL中队列容器基于容器适配器的实现原理   * 1. Grasp the use of queue container in a real application   掌握队列容器的常用接口和使用方法，能够利用队列容器解决现实应用问题   * 1. Know the concept of simulation and can use simulation to solve a real problem; Know about the queueing theory and the exponential distribution theory   了解仿真的概念和原理，能够使用基于队列的仿真技术解决现实问题；了解排队论理论和指数分布理论，能够利用相关理论知识结合队列编程对现实问题进行理论分析和算法、工程改进。 | | | | | |
| 1. **Experimental environment (**platform and software**)（实验环境）**   Windows 7 (or higher versions) + Visual Studio 2010 (or higher versions) | | | | | |
| 1. Experimental content and design (Main Content, Procedure, Codes and Results)（此部分应包含每一个实验内容的详细设计，含实验思路、详细实验步骤、核心代码说明等）   Task 1  Improve the car wash simulation problem in the following ways based on the codes.  基于所提供代码，按要求实现改进的洗车仿真程序。具体要求如下。   * 1. Do not restrict the capacity of the car wash station.   不限制洗车服务台的容量。在这种情况下，洗车程序的终止条件可根据需要自行设定，例如可设定清洗车辆的数量上限，或者设定汽车到达时间的上限。   * 1. The inter-arrival time should be generated from an exponential distribution randomly. Let be the inter-arrival time, then follows an exponential distribution with cumulative distribution function   The parameter represents the arrival rate, which equals the reciprocal of the mean inter-arrival time, that is,  The arrival rate should be provided by the user.  汽车的到达时间间隔 服从指数分布，在仿真时需根据指数分布进行随机采样。为此，需要用户设定汽车的到达率，即平均到达时间间隔的倒数：  这样，到达时间间隔满足的指数分布具有累积分布函数：   * 1. The service time for each car should also be generated from an exponential distribution randomly via   The parameter represents the service rate, which equals the reciprocal of the mean service time, that is,  The service rate , or equivalently, the mean service time should be provided by the user. Note that mean service time should be less than mean inter-arrival time, which means should be greater than  汽车的服务时长也服从指数分布，在仿真时同样需根据指数分布进行采样。为此，需由用户设定服务台的服务率，即平均洗车时长的倒数：  这样，洗车时长服从的累积分布函数为  注意在你的设定中平均服务时长应该小于平均到达时间间隔，这意味着 >   * 1. To generate a random number satisfying exponential distributions, you could adopt the formula:   for inter-arrival time; or  for service time, with , a random number sampled from (0, 1) by uniform distribution.  为对到达时间间隔和洗车时长进行指数分布采样，可分别借助公式  和  进行计算，其中，, 是通过均匀分布产生的(0, 1)范围内的随机数。   * 1. Run multiple rounds of simulation, and each time record the obtained mean average waiting time and maximal queue length. See if your calculated average waiting time equals the theoretical value:   In this way you can certify the correctness of your simulation program.  进行多轮仿真实验，记录每次获取的所有汽车平均等待时长和最大等待队列长。计算分析你获取的平均等待时长是否与理论数值  接近。由此可验证你所编写仿真程序的正确性。 | | | | | |
| 1. **Result analysis and discussion**（Analysis of experimental results and summing up the harvest and the existing problems）（此部分应包含实验结果，对实验结果的分析，实验收获的总结，实验中存在问题的讨论等；另外，需要回答一下如下思考题：   1）假设你仿真获得了一些洗车服务的指标，如平均等待时长，最大队列长度，等等，发现这些指标不满足洗车公司的设计需求，不能为顾客提供较好的服务。这时，一种改进的策略是增设一个服务台，用两个服务台同时提供汽车清洗服务。那么，怎么修改你的程序能够为这种双服务台系统进行仿真分析？可以简述你的设计思路，也可以编写代码验证你的思路。） | | | | | |
| Comments & Evaluation | Content & Design (A-E) | | |  | |
| Procedure & Codes (A-E) | | |  | |
| Results (A-E) | | |  | |
| Analysis & Discussion (A-E) | | |  | |
| Score (A-E):  Feedback comments: | | | | |