**Name: Loïc Galland (lg222sv)**

1. **Service times**

|  |  |
| --- | --- |
| Name of service center | Service Time (Sk) |
| *WebServer* | **0.059996** |
| *ApplicationServer* | **0.24998** |
| *VoucherPaymentServer* | **0.3000019** |

1. **Simulation results**

|  |  |  |
| --- | --- | --- |
| Name of service center | Utilization | Throughput |
| *WebServer* | **18.45%** | **3.0990** |
| *ApplicationServer* | **77.04%** | **3.0665** |
| *Database* | **43.20%** | **12.2967** |
| *CardPaymentServer* | **34.88%** | **1.7380** |
| *VoucherPaymentServer* | **22.37%** | **0.7492** |

|  |
| --- |
| 30.6247 s |

Average System Response Time:

|  |
| --- |
|  |

Average time that a user is waiting for a reply from the system

1. **System upgrade**

|  |  |  |  |
| --- | --- | --- | --- |
| Name of service center | Minimum number of resources | Utilization | Throughput |
| *WebServer* | **2** | **0.7666** | **25.8064** |
| *ApplicationServer* | **7** | **0.9036** | **25.7591** |
| *Database* | **4** | **0.9027** | **102.4552** |
| *CardPaymentServer* | **3** | **0.9715** | **14.3460** |
| *VoucherPaymentServer* | **2** | **0.9208** | **6.1695** |

|  |
| --- |
| 40.5655 s |

Average System Response Time:

|  |
| --- |
|  |

Average time that a user is waiting for a reply from the system

Calculations:

A )

We know:

**WEBSERVER**

T = 259200 s

Vweb = 1.7361 visits

Dweb = 0.10416s

C = 466560

Vk = Ck / C

Ck = Vk\*C = 1.7361\*466560 = 809994.816

Dk = Vk\*Sk

Sk = Dk/Vk = 0.10416/1.7361 = **0.059996** s

Xk = Ck/T = 809994.816/259200 = **3.12498**

Uk = Xk\*Sk = 3.12498 \* 0.059996 = **0.187468**

**Application Server**

We know:

Uk = **78.12** %

N = 3.565

R = 1.1408

N = X\*R

X = N / R = 3.565 / 1.1408 = **3.125**

Uk = Xk \* Sk

Sk = Uk/Xk = 0.7812 / 3.125 = **0.24998**

**Voucher Server**

Uk = 22.5%

Ck = 809994.816 \*0.8\*0.3 = **194398.75584**

Xk = Ck / T = 194398.75584 / 259200 = **0.7499952**

Uk = Xk\*Sk

Sk = Uk / Xk = 0.225 / 0.7499952 = **0.3000019 s**