

**OPER 441****Quiz # 1****First Semester 1444****Department of Statistics and Operations Research
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الرقم:

الاسم:

الرجاء كتابة النتائج في الخلايا المناسبة**Problem 1 :** Fill the Table الجدول بملاً الجدول.

| Customer | Interarrival arrival time | Arrival time | Service time | Service begins | Service ends | Waiting time in queue | Waiting time in system | Idle time of server |
|--------------|---------------------------|--------------|--------------|----------------|--------------|-----------------------|------------------------|---------------------|
| 1 | 5 | 5 | 6 | 5 | 11 | 0 | 6 | 0 |
| 2 | 8 | 13 | 1 | 13 | 14 | 0 | 1 | 2 |
| 3 | 3 | 16 | 6 | 16 | 22 | 0 | 6 | 2 |
| 4 | 6 | 22 | 6 | 22 | 28 | 0 | 6 | 0 |
| 5 | 1 | 23 | 4 | 28 | 32 | 5 | 9 | 0 |
| 6 | 4 | 27 | 2 | 32 | 34 | 5 | 7 | 0 |
| 7 | 5 | 32 | 6 | 34 | 40 | 2 | 8 | 0 |
| 8 | 5 | 37 | 5 | 40 | 45 | 3 | 8 | 0 |
| 9 | 2 | 39 | 5 | 45 | 50 | 6 | 11 | 0 |
| 10 | 3 | 42 | 2 | 50 | 52 | 8 | 10 | 0 |
| 11 | 7 | 49 | 3 | 52 | 55 | 3 | 6 | 0 |
| 12 | 2 | 51 | 2 | 55 | 57 | 4 | 6 | 0 |
| 13 | 7 | 58 | 3 | 58 | 61 | 0 | 3 | 1 |
| 14 | 1 | 59 | 3 | 61 | 64 | 2 | 5 | 0 |
| 15 | 3 | 62 | 1 | 64 | 65 | 2 | 3 | 0 |
| TOTAL | 62 | 535 | 55 | | | 40 | 95 | 5 |

احسب القيم التالية:

| \bar{T} | \bar{S} | W_q | W_{wait} | $P(wait)$ | P (idle server) |
|------------|------------|------------|------------|------------|----------------------|
| 62/15=4.13 | 55/15=3.67 | 40/15=2.67 | 40/10=4 | 10/15=0.67 | 5/65=0.08 |

Problem 2: Consider the following LCG : $R_i = 13R_{i-1} + 13 \pmod{16}$, $R_0 = 14$.

1. Fill the following table

| i | R_i | $U_i = \frac{R_i}{m}$ |
|-----|-------|-----------------------|
| 1 | 13 | 0.8125 |
| 2 | 10 | 0.625 |
| 3 | 3 | 0.1875 |
| 4 | 8 | 0.5 |
| 5 | 9 | 0.5625 |
| 6 | 6 | 0.375 |
| 7 | 15 | 0.9375 |
| 8 | 4 | 0.25 |
| 9 | 5 | 0.3125 |
| 10 | 2 | 0.125 |
| 11 | 11 | 0.6875 |
| 12 | 0 | 0 |
| 13 | 1 | 0.0625 |
| 14 | 14 | 0.875 |
| 15 | 7 | 0.4375 |
| 16 | 12 | 0.75 |
| 17 | 13 | 0.8125 |
| 18 | 10 | 0.625 |
| 19 | 3 | 0.1875 |
| 20 | 8 | 0.5 |

2. Does this generator achieve the maximum possible period length? (Use the table).

If the answer is yes, then what is the length of the period ?.

Yes, this generator achieves the maximum period length $m = 16$.

Problem 3 : Consider the following set of random numbers (see table الجدول).

Test the hypothesis that these numbers are drawn from $U(0,1)$ at a 95% confidence Interval ($\alpha = 0.05$) using the Kolmogorov-Smirnov test. (استعمال الجدول)

| i | R_i | $R_{(i)}$ | $\frac{i}{N} - R_{(i)}$ | $R_{(i)} - \frac{(i-1)}{N}$ |
|-----|--------|-----------|-------------------------|-----------------------------|
| 1 | 0.8717 | 0.0427 | 0.023967 | 0.0427 |
| 2 | 0.0427 | 0.1317 | 0.001633 | 0.065033 |
| 3 | 0.5906 | 0.2213 | 0 | 0.087967 |
| 4 | 0.8565 | 0.2298 | 0.036867 | 0.0298 |
| 5 | 0.2298 | 0.3081 | 0.025233 | 0.041433 |
| 6 | 0.4699 | 0.3374 | 0.0626 | 0.004067 |
| 7 | 0.8655 | 0.4699 | 0 | 0.0699 |
| 8 | 0.5228 | 0.5228 | 0.010533 | 0.056133 |
| 9 | 0.3374 | 0.5666 | 0.0334 | 0.033267 |
| 10 | 0.1317 | 0.5906 | 0.076067 | 0 |
| 11 | 0.2213 | 0.611 | 0.122333 | 0 |
| 12 | 0.6110 | 0.8012 | 0 | 0.067867 |
| 13 | 0.3081 | 0.8565 | 0.010167 | 0.0565 |
| 14 | 0.5666 | 0.8655 | 0.067833 | 0 |
| 15 | 0.8012 | 0.8717 | 0.1283 | 0 |

$$D_+ = 0.1283, \quad D_- = 0.087967, \quad D = 0.1283, \quad D_{0.05} = 0.338 \quad (n = 15)$$

Conclusion: Since $D < D_{0.05}$, Therefore we accept that the set of random numbers follow the uniform distribution on $[0,1]$.