Assignment 2

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Q1

A computer system has enough room to hold 6 processes in its main memory. These processes are idle waiting for I/O 65% of the time. What is the utilization of the CPU? Show your answer steps in detail.

With process count $n = 6$ and wait time probability of $p = .65$:

$$\begin{aligned} \text{CPU\_Util} &= 1 - p^n \\ &= 1 - (.65)^6 \\ &\approx 1 - 0.075 \approx 0.925 \end{aligned}$$

This gives us a CPU Utilization factor of 92.5%.

Q2

The CPU Utilization of a computer system with a large memory size was 40% with executing 6 processes that have the same I/O characteristics. How many processes from the same type should be executed to achieve around 94% CPU Utilization? Show your answer steps in detail.

Using the formula for CPU Utilization based on process count $n = 6$ and CPU Utilization of 40%, we can work out the I/O characteristic p.

$$\begin{aligned} 0.40 &= 1 - (p)^6 \\ (p)^6 &= 1 - 0.40 = 0.60 \\ p &= 0.40^{\frac{1}{6}} \approx 0.9184 \end{aligned}$$

We have thus determined that the I/O characteristic is approximately 91.84% for the processes in this system. We use the formula again then to determine the process count n such that we achieve approximately 94% CPU Utilization.

$$
\begin{aligned}
0.94 &= 1 - (0.9184)^n \\
(0.9184)^n &= 1 - 0.94 = 0.06 \\
\ln 0.9184^n &= \ln 0.06 \\
n \times \ln 0.9184 &= \ln 0.06 \\
n &= \frac{\ln 0.06}{\ln 0.9184} \\
n &\approx 33
\end{aligned}
$$

Therefore, we know that this system would require 33 similar class processes to achieve 94% CPU Utilization.