UM–SJTU Joint Institute

Introduction to Operating Systems

(VE482)

Homework 2

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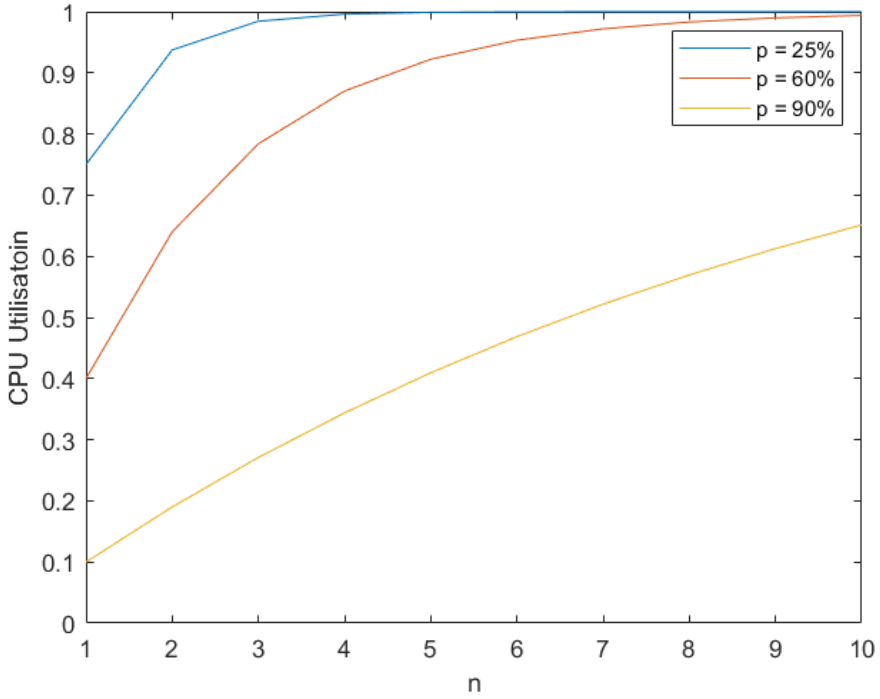
Ex.1 – *MultiProgramming*

1. The probability for n processes to be waiting at the same time is p^n.
   The CPU utilisation is $1 - p^n$.

2. The curve representing CPU utilisation with different p is shown below.



3. a) After loaded the light operating system, we know that

$$\lfloor (256 - 96) \div 48 \rfloor = 3$$

   Therefore, 3 processes can be stored simultaneously in memory.

   b) From previous question, we know that the CPU utilisation can be calculated by

$$1 - 0.9^3 = 27.1\%$$

   Therefore, the CPU utilisation in this case is 27.1%.

   c) If 256 MB is added, $\lfloor (512 - 96) \div 48 \rfloor = 8$ processes can be stored simultaneously in memory, the CPU utilisation will be $1 - 0.9^8 \approx 56.95\%$, which increases by $(56.95\% \div 2) - 27.1\% = 29.85\%$ per 256 MB.
   If 512 MB is added, $\lfloor (768 - 96) \div 48 \rfloor = 14$ processes can be stored simultaneously in memory, the CPU utilisation will be $1 - 0.9^14 \approx 77.12\%$, which decreases by $|(77.12\% \div 3) - 27.1\%| = 1.39\%$ per 256 MB.
   If 1024 MB is added, $\lfloor (1280 - 96) \div 48 \rfloor = 24$ processes can be stored simultaneously in memory, the CPU utilisation will be $1 - 0.9^24 \approx 92.02\%$, which decreases by $|(92.02\% \div 5) - 27.1\%| = 8.7\%$.
   As a result, adding 256 MB will be the most beneficial and worth the investment.

Ex.2 – *Keymap in Minix 3*