Problem - 1

Assume 2 computers A & B and a set of SPECRation for Each.

$$\frac{\text{Geometric Mean}_A}{\text{Geometric Mean}_B} = \frac{\sqrt[n]{\prod_{i=1}^{n} \text{SPECRation}_{A_i}}}{\sqrt[n]{\prod_{i=1}^{n} \text{SPECRation}_{B_i}}}$$

$$= \sqrt[n]{\prod_{i=1}^{n} \frac{\text{SPECRation}_{A_i}}{\text{SPECRation}_{B_i}}}$$

$$= \sqrt[n]{\prod_{i=1}^{n} \frac{\text{Exec\_time}_{ref}}{\text{Exec time}_{A_i}} \Big/ \frac{\text{Exec-time}_{ref}}{\text{Exec-time}_{B_i}}}$$

$$= \sqrt[n]{\prod_{i=1}^{n} \frac{\text{Perf}_{A_i}}{\text{Perf}_{B_i}}}$$

$$= \sqrt[n]{\frac{n\text{Exec\_time}_{B_i}}{\prod_{i=1}^{n} \text{Exec time}_{A_i}}}$$

$$\frac{\text{GM}_A}{\text{GM}_B} = \sqrt[n]{\prod_{i=1}^{n} \frac{\text{Perf}_{A_i}}{\text{Perf}_{B_i}}}$$

Promblem-2

2.1) $S = \frac{1}{((1-0.8)+\frac{0.8}{N})} = \frac{1}{0.2+\frac{0.8}{N}}$

2.2) $S = \frac{1}{((1-0.8)+8\times 0.005+\frac{0.8}{8})}$

$= \frac{1}{0.2+0.04+0.1} = 2.94$

2.3) 1-2-4-8 (3 hops)

$= \frac{1}{((1-0.8)+3\times 0.005+\frac{0.8}{8}}$

$= \frac{1}{0.2+0.015+0.1} = \frac{1}{0.315} = 3.174$

2.4) $= \frac{1}{((1-0.8)+0.005\times \log_2 N+\frac{0.8}{8}}$

2.5)

$$S = \frac{1}{\left(1 - 0.005P + 0.005\log_2 N + \frac{0.005P}{N}\right)}$$

The derivative should be 0.

$$-1 * \left(\frac{0.005}{N \log_e 2} - \frac{0.005P}{N^2}\right) = 0$$

$$\left(1 - 0.005P + 0.005\log_2 N + \frac{0.005P}{N}\right)^2$$

$$\frac{0.005}{N \log_e 2} - \frac{0.005P}{N^2} = 0$$

$$N^2 = PN\log_e 2$$

$$N = P\log_e 2$$

3) Memory hierarchy arranges different storage types based on cost & access speed. it is used as a guide to build efficient system by arranging memory to reduce access time while also maintaining optimal cost.

Problem 4

$2 has 210 $4 has 3

add $2, $4, $2

$2 = 3 + 210

$2 = 213

mul $1, $2, $4

$1 = 213 × 4

$1 = 852

Sub $1, $1, $4

$1 = 852 - 3

= 849

addi $1, $1, 3

$1 = 849 + 3

= 852

Problem -5

5.1) $\left(6 \times \frac{25}{100}\right) + \left(1.44 \times \frac{75}{100}\right) =$

$= 1.5 + 1.08 = 2.58$

5.2)

new FPSQR = $CPI_{original} - 4\% (CPI_{OF} - CPI_{UF})$

$= 2.58 - \frac{4}{100} * (30 - 4)$

$= 1.54$

5.3) $CPI_{NewFP} = (75\% \times 1.44) + (25\% \times 3)$

$= \left(\frac{75}{100} \times 1.44\right) + \left(\frac{25}{100} \times 3\right)$

$= 1.08 + 0.75$

$= 1.83$

5.4) We should choose the first design alternative as the CPI is lower