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CSE-461 – Homework 2

Question 1:

A. The graph is a claim limited graph because it has consumable resources, and all are in use.
B. A process can be a producer or a consumer of resources, so the graph can be reducible. Because:
    1. P_1 is producer of R_2
    2. P_2 and P_3 are consumers of R_2
    3. P_2 is producer of R_1
    4. P_1 is consumer of R_1

Question 2:

A. Proof by contradiction: R < P (N * P (n - 1) + 1 is true.
B. The given statement is true because assuming that the system has at least p(n - 1) + 1 units of a resource. It will have at least one free unit which can be allocated to a process to finish its task, and when this process is terminated the held units are freed and returned to the system. The freed units can then be used to terminate other processes.

Question 3:

A. The graph is expedient because all processes have outstanding requests are blocked.
B. Yes, there is a knot within the graph using (P1, P2, R1, R2) because as a node is reachable from any other node, but no other node in the graph can be reached from a node.
C. The knot that can be created within the graph can cause deadlocks.

Question 4:

We first must find the weighted average for the mean of how long a request can take which can be found with: $W = \frac{2}{3} * 15 + \frac{1}{3} * 90$ which equals 40 msec. So, the server can do 1000/40 = 25 requests per second, and for a multithreaded server it can do 66.66 requests per second.

Question 5:

A. Matrix $D = A - \sum_{k=1}^{n} C_k$

    Finding D: D = (524) – (322) = 202

    Finding E: E = B – C

$$\begin{pmatrix} 2 & 2 & 2 \\ 1 & 2 & 2 \\ 3 & 1 & 3 \end{pmatrix} - \begin{pmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 2 \end{pmatrix}$$

$$E = \begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 2 \end{pmatrix}$$

B. $F_1 = (0 \quad 0 \quad 0)$

Finding D: $D = D - F_1$

$$D = (2 \quad 0 \quad 2) - (0 \quad 0 \quad 1)$$

$$D = (2 \quad 0 \quad 1)$$

Finding C: $C = C + F_1$

$$\begin{pmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix} + (0 \quad 0 \quad 1) = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

$$C = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

Finding E: $E = E - F_1$

$$\begin{pmatrix} 1 & 1 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 2 \end{pmatrix} - (0 \quad 0 \quad 1) = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ 2 & 0 & 2 \end{pmatrix}$$

$$E = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ 2 & 0 & 2 \end{pmatrix}$$

C. The request shouldn’t be granted as the system is not in a safe state, we can find this by using safe-state check algorithm:

$$P_1(1 \quad 1 \quad 1) \le (2 \quad 0 \quad 1)\ False$$

$$P_2(0 \quad 2 \quad 1) \le (2 \quad 0 \quad 1)\ False$$

$$P_3(2 \quad 0 \quad 2) \le (2 \quad 0 \quad 1)\ False$$

So the system isn’t in a safe state and will remain unfinished.