Waled Salem
CSE 461
Homework 2
Score 50/50

1a) The graph is claim-limited because every resource has no available units and has a request edge (Pi, Rj) if and only if Pi is a consumer of Rj.

1b) The graph is reducible because P3 is a producer of R2 units and can complete P1 request of R2, therefore P1 is a producer for R1 and can complete the P2 request

2a) Because this system is deadlock free all processes can be completed and if the amount of needed resources is sufficient then each process will be terminated before others are called and needed to be completed. In the worst case scenario each system will need P(n-1) + 1 to release each process if there are n-1 units. Thus if the system wants to be deadlock free, it must have R>=P(N-1) + 1 reusable resources.

2b) To prove this statement we need to again look at the worst case scenario, in the worst case scenario all of the processes are assigned N - 1 units and each of these processes is requesting an additional unit. However in this case, each unit can share the resource, meaning use the same resource interchangeably. Essentially with this sequence of interchanging free resources the statement is true and the system can remain deadlock free.

3a) The graph is expedient, since for a graph to be expedient all the process requests must be blocked, as is the case for this graph.

3b) There is a knot in this graph in the loop of states {P1, P2, R1, R2}, since all these nodes are reachable from every x node, there exists a knot.

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3c) Yes, since the system has a knot the system already qualifies for the criteria of having a deadlock.

4. Using the formula

Single Thread:

Average = $((\frac{2}{3}) * 15) + ((\frac{1}{3} * 90))$ = 40 ms = 25 req/s

Multi-thread:

1000/15 ms = 66.667 requests per second

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5.

Max Avail-A = $(5 \ 2 \ 4)$

Max Claim B = $\begin{pmatrix} 2 & 2 & 2 \\ 1 & 2 & 2 \\ 3 & 1 & 3 \end{pmatrix}$

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

a) Available D = $(2 \ 0 \ 2)$

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

b) F1 = $(0 \ 0 \ 1)$

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

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

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

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5.c) To maintain the security of the system, the request should not be granted. Since resource D cannot fulfil any of the needs of the processes. Before accepting P1, the only process that can be fulfilled by any of the available processes is P3 because P3 needs (2 0 2) which is available. But P1 needs (1 1 1) and (2 0 1) is available and P2 needs (0 2 1) but only has (2 0 1). This will cause a security problem which is why the request should not be granted.

I have completed all the problems and I believe I deserve a 50/50 on this homework assignment. Thank you.