

Tutorial #5

Program Design

The N-Generals Problem (where N is any number)



Instructions:

WELL DONE! Based on the success of the strategies you suggested for Tutorial #3 (which was The 2-Generals Problem) the two Generals armies have successfully conquered several enemy cities and have been so successful that several more armies have joined them, each with their own General.

Now we have N Generals (where N is any number), and because they are so excellent at communicating secretly during battle (thanks to you!), we are now able to appoint one General as the Coordinator General, who will suggest a time to attack a new enemy city, and after they decide on a time, they will check if every other General is ready to attack at that time, and if they all are, the Coordinator General will let them know to attack. This strategy is called a *Two-Phase Commit*, since we have two phases, a checking phase and an attack phase.

In the following two pages, I've given you the pseudocode for both the Coordinator General and all the other generals, *in groups of three or four students*, express this pseudocode as flowcharts. Draw the flowcharts in Powerpoint and printscreen them into your portfolio.

Submission: In the same Word document you have with all your labs and tutorials:

PROGRAM-DESIGN-PORTFOLIO.DOCX (or .DOC)

add in the two flowcharts, and the names of the people in your group. e-mail your document to Damian.Gordon@dit.ie with a subject heading of PROGRAM DESIGN TUTORIAL #5 and in the message of your e-mail please let me know your full name, your student number, the name of your programme, the programme code, the name of the module, the year you are in (first year), and your assignment.

PLEASE NOTE: If you do not have the correct subject heading on your e-mail, or the correct filename, your submission WILL be rejected.

Marking: Please note, this tutorial is due for submission today at the end of this session. Each of these tutorials contributes to your final result in this module, so it's best to get the earlier ones done as well as you can, because as the labs continue on they will get harder, so you might as well pick up the easy marks early on.

"Study hard what interests you the most in the most undisciplined, irreverent and original manner possible." - Richard P. Feynman

The PseudoCode for the Coordinator General is:

```
PROGRAM 2PhaseCommit-Coordinator:
DoAttack = TRUE; /* Assume all generals will agree */

/* Send requests to everyone */
Send Request to First General;
WHILE (Not all Requests sent to other Generals)
    DO Send Request to Next General;
ENDWHILE;

/* Wait for responses from everyone */
WHILE (Not all Responses received from other Generals)
    DO IF (Current Response != "OK to Attack")
        THEN DoAttack = FALSE;
    ENDIF;
    IF (No Response received by time limit)
        THEN Retransmit Request;
    ENDIF;
ENDWHILE;

/* Sent final orders */
WHILE (Not all Final Orders sent to other Generals)
    DO IF (DoAttack == TRUE)
        THEN Send Message "We are ready to attack";
        ELSE Send Message "We are NOT ready to attack";
    ENDIF;
ENDWHILE;

END.
```

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The PseudoCode for the Other Generals is:

```
PROGRAM 2PhaseCommit-OtherGenerals:
```

```
/* Wait for Request from Coordinator General */
```

```
WHILE (No Request received)
```

```
    DO Wait;
```

```
ENDWHILE;
```

```
/* Request now received, so let the coordinator know whether  
or not you are ready to attack */
```

```
IF (Ready to Attack)
```

```
    THEN Send Message "OK to attack";
```

```
    ELSE Send Message "Not ready to attack";
```

```
ENDIF;
```

```
/* Wait for Final orders */
```

```
WHILE (No Final orders received)
```

```
    DO Wait;
```

```
ENDWHILE;
```

```
/* Act on orders */
```

```
IF (Message == "We are ready to attack")
```

```
    THEN Attack at specified time;
```

```
ENDIF;
```

```
END.
```

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