Implementing Mutual Exclusion in Shared Memory

Peterson’s and Bakery Algorithma

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Outline of the Presentation

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The problem

Tell a STORY from the background to the conclusion

The Problem Name

Explain the problem here. Instead of using the term 'The problem", please use specific name for the problem. Tell us a story. Provide a picture for the scenario depicting the problem. Set the scene for average audience.

Spend at least **1.5-2 minutes per slide** on average.
The introduction should be something like "I will be presenting title of talk. This is joint work with your colleagues or advisor at institution."

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What is the solution/contribution

Explain **YOUR** contributions. Go top-down. Give the brief introduction to the contributions at the beginning of the presentation. A slide should have no more than five to six lines of text or bullets. Prefer figures instead of text: A picture is worth a thousand words.

- Communicate the Key Ideas
- Don't get Bogged Down in Details
- Use a Top-down Approach

The audience will remember at most one single message **Which message you want to audience to remember? Can you express this message in less than a minute in an elevator?**

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Motivation/Importance

“Gain upon solving the problem, pain if not solved” should be explained

Disturbed systems with many process, while working on the same data, it is common for many processes to want to access or modify it at the same time. But a process changing the data while the other is reading it might create unwanted effects. Mutual exclusion is a common way of handling these effects. This enables multiple processes to work on the same piece of data, which is one of the most fundamental capabilities requested from a distributed system.

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Model, Definitions

Formal definition of a Stochastic Process

When a process wants to modify a piece of data that is being accessed by others, it creates a **race condition**.

Regions of code that modifies the shared memory, meaning regions that might cause race conditions are called the **critical section**.

Mutual exclusion is the methodology of allowing only a single process to enter a critical section at a time.

Background

Research is not usually carried out in a vacuum. There will almost always be other relevant or related work, which you should describe. Present an orderly synopsis of these previously- obtained results. A table is often used for this purpose. Be sure to mention the author of each paper and its date of publication. **Compare and contrast them with each other and with your paper.**

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SharedExclusion Algorithm 1

Peterson's Algorithm

Peterson's Algorithm [1] prevents 2 processes from entering the critical section in the same time. It achieves this by a way of each process giving way to other. When the process comes to the critical section, it first allows the other process to continue to the critical section and only moves forward if the other is not currently trying to enter the critical section or if the other process finishes its work within the critical section. While it is a gentleman's way of handling shared memory exclusion, its main limitation lies in the fact that it only works for 2 processes.

SharedExclusion Algorithm 1

Peterson's Algorithm

```
Data: Processes $p_i$ where $i \in \{0, 1\}$
initialization;
turn $\leftarrow$ F;
waiting[2];
algorithm;
if $p_i$ wants to enter CS then
    waiting[$i$] $\leftarrow$ T;
    turn $\leftarrow 1 - i$;
    while $waiting[1 - i] = T$ and $turn = 1 - i$ do no-op;
    $p_i$ enters CS;
    $p_i$ exits CS;
    waiting[$i$] $\leftarrow$ F;
end
```

Algorithm 1: Peterson's algorithm

SharedExclusion Algorithm 2

Bakery Algorithm

Bakery Algorithm [2] simulates the activity of waiting in a line in its namesake to get your order. Every process takes a ticket with a number on it. When their number flashes on the screen, they come and give their order. If two processes have the same number on their ticket, the conflict is resolved through seniority, just like letting an elderly person go before you when both of you arrive at the same time.

SharedExclusion Algorithm 2

Bakery Algorithm

```
Data: Processes $p_i$ where $i \in [1, n]$
initialization;
entering[$n$];
ticket[$n$];

algorithm;
if $p_i$ wants to enter CS then
    entering[$i$] $\leftarrow$ T;
    ticket[$i$] $\leftarrow$ max(ticket) $+ 1$;
    entering[$i$] $\leftarrow$ F;

    for $j \leftarrow 1$ to $n$ do
        while $entering[j] = T$ do no-op;
        while $ticket[j] \neq 0$ and $(ticket[j], j) < (ticket[i], i)$ do no-op;
    end

    $p_i$ enters CS;

    $p_i$ exits CS;

    ticket[$i$] $\leftarrow 0$;
end
```

Algorithm 2: Bakery algorithm

Main Point 2

Explain the Significance of the Results

Pause, and explain the relationships between the formal theorems that you have just presented and the informal description that you gave in the Introduction. Make it clear to the audience that the results do live up to the advance publicity. If the statements of the theorems are very technical then this may take some time. It is time well-spent.

Main Point 3

Sketch a Proof of the Crucial Results

The emphasis is on the word “sketch”. Give a very high-level description of the proofs, emphasizing the proof structure and the proof techniques used. If the proofs have no structure (in which case it may be assumed that you are not the author of the paper), then you must impose one on them. Gloss over the technical details. It is a good idea to point them out but not to explore them.

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Main Result 1

Choose **just the key results**. They should be important, non-trivial, should give the flavour of the rest of the technical details and should be presentable in a relatively short period of time. Use figures instead of tables instead of text.
Better to present 10% the entire audience gets than 90% nobody gets

Main Result 2

Try a subtitle

- Make sure your notation is clear and consistent throughout the talk. Prepare a slide that explains the notation in detail, in case that is needed or if somebody asks.
- Always label all of your axes on graphs; use short but helpful captions on figures and tables. It is also very useful to have an arrow on the side which clearly shows which direction is considered better (e.g., ”up is better”).
- If you have experimental results, make sure you clearly present the experimental paradigm you used, and the details of your methods, including the number of trials, the specific analysis tools you applied, significance testing, etc.
- The talk should contain at least a brief discussion of the limitations and weaknesses of the presented approach or results, in addition to their strengths. This, however, should be done in an objective manner – don’t enthusiastically put down your own work.

Main Result 3

- If time allows, the results should be compared to the most related work in the field. You should at least prepare one slide with a summary of the related work, even if you do not get a chance to discuss it. This will be helpful if someone asks about it, and will demonstrate your mastery of the material.
- Spell check again.
- Give for each of the x-axis, y-axis, and z-axis
- Label, unit, scale (if log scale)
- Give the legend
- Explain all symbols
- Take an example to illustrate a specific point in the figure

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Conclusions

Hindsight is Clearer than Foresight

Advices come from [3].

- You can now make observations that would have been confusing if they were introduced earlier. Use this opportunity to refer to statements that you have made in the previous three sections and weave them into a coherent synopsis. You will regain the attention of the non- experts, who probably didn't follow all of the Technicalities section. Leave them feeling that they have learned something nonetheless.
- Give Open Problems It is traditional to end with a list of open problems that arise from your paper. Mention weaknesses of your paper, possible generalizations, and indications of whether they will be fruitful or not. This way you may defuse antagonistic questions during question time.
- Indicate that your Talk is Over An acceptable way to do this is to say "Thank-you. Are there any questions?"[4]

References

[1] G. Peterson, “Myths about the mutual exclusion problem,” *Information Processing Letters*, vol. 12, no. 3, p. 115–116, Jun 1981.

[2] L. Lamport, “A new solution of dijkstra’s concurrent programming problem,” *Communications of the ACM*, vol. 17, no. 8, p. 453–455, Aug 1974.

[3] B. Spillman and I. Parberry, “How to present a paper: A speaker’s guide,” *North American Membrane Society*, 2000.

[4] A. Einstein, “Zur Elektrodynamik bewegter Körper. (German) [On the electrodynamics of moving bodies],” *Annalen der Physik*, vol. 322, no. 10, pp. 891–921, 1905.

How to prepare the talk?

Please read http://larc.unt.edu/ian/pubs/speaker.pdf

- The Introduction: Define the Problem, Motivate the Audience, Introduce Terminology, Discuss Earlier Work, Emphasize the Contributions of your Paper, Provide a Road-map.
- The Body: Abstract the Major Results, Explain the Significance of the Results, Sketch a Proof of the Crucial Results
- Technicalities: Present a Key Lemma, Present it Carefully
- The Conclusion: Hindsight is Clearer than Foresight, Give Open Problems, Indicate that your Talk is Over

Questions

THANK YOU

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