Parallelism for Beginners with Fun Examples*

*Lightning talk

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***Abstract*—**
Fun examples for demonstrating parallelism to beginners are presented:

- **Assembling in parallel a 3D jigsaw puzzle ball.**
- **Parallel sorting of binary coded numbered cards.**
- **The twenty-one card trick and its generalizations**

***Keywords*—**
Parallelism, Flexible algorithms, Flexible computation.

I. Introduction

It is challenging to introduce parallelism to complete beginners. The examples used need to simple and yet allow a parallel solution. With the first example, children can participate in the parallel activity. The second example can be demonstrated to children as a magic trick. The third example is suitable for first year university students and (gifted) students in their final year of secondary/high school.

II. The Fun Examples

A. *Assembling in parallel a 3D jigsaw puzzle ball*

The pieces are numbered on the reverse side.

This is how we can work on this in parallel:

a) Divide the pieces into piles:
Pile of pieces numbered 1 to 9
Pile of pieces numbered 10 to 19
Pile of pieces numbered 20 to 29
Pile of pieces numbered 30 to 39
Etc.

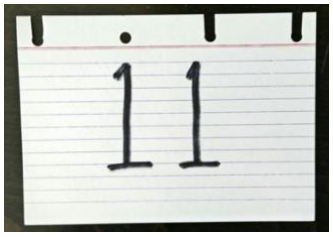
b) Assemble pieces in each pile - done in parallel (or sequentially).

c) Join the partially assembled sections of the ball together - done in parallel (or sequentially).

Can final year students find such a solution?
Please ask your students and let me know the outcome.

B. *Parallel sorting of binary coded numbered cards*

Binary numbers are coded on the edge of the card by means of slots and holes.



Now watch this video:
http://homedir.jct.ac.il/~rafi/ParBegFun/VIDEO_1.mp4

This was shown to me when I was in secondary/high school without any mention of parallelism!

C. *The twenty-one card trick and its generalizations*

Cards are dealt row by row into 7 rows by 3 columns. The full presentation contains explanations (including videos) as to why this trick works.

It also contains:

- Exercises to implement this solution sequentially and in parallel.
- An inductive proof that the trick works whenever both the number of rows and columns are odd. i.e. cards dealt row by row into (2m+1) rows by (2n+1) columns. m, n are positive integers.

Here is the link to the full presentation:
http://homedir.jct.ac.il/~rafi/ParBegFun/ParBegFun(slides).pdf

III. Conclusion

First examples and exercises should have similar sequential and parallel solutions. Preferably they should be solvable without a computer and parallelism should be introduced or demonstrated at the very beginning. (Many such examples can be found in our course notes about Flexible Algorithms [1] and a survey of this course appears in [2].)

References

[1] R. B. Yehezkael, "Flexible Algorithms: An Introduction", Course Notes, Jerusalem College of Technology, Revised 2013 - תשע"ג. Available at http://homedir.jct.ac.il/~rafi/flexalgo.pdf

[2] R. B. Yehezkael, "Flexible Algorithms: Overview of a Beginners' Course", IEEE Distributed Systems Online, vol. 7, no. 11, 2006, art. no. 0611-oy002. Available at http://homedir.jct.ac.il/~rafi/oy002.pdf