Finale

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Logistics

Today

- Parallel Languages / Environments
- Wrap-up and Review

Schedule

Tue 4/26	Applications
Thu 4/28	Last Lecture Parallel Languages Review
Mon 5/02	Course Evals Due Last Day of Classes
Mon 5/09	Final Exam 8:00-10:00am Lecture Location

Further Coursework

- **CSCI 8205 Parallel Computer Organization**: Study hardware issues associated with parallel / multicore machines. Requires significant Hardware background.
- **CSCI 5304 Computational Aspects of Matrix Theory**: Deep dive into using matrices and linear algebra in computing. Essential stuff for those in scientific computing with any self-respect.
- **CSCI 8314 Sparse Matrix Computations**: Focused on sparse operations, offered periodically.
- **Application Areas:** Have seen that machine learning, graphics, cryptography, physical simulations, etc. all benefit from parallel computing. Find a serial algorithm in your domain and parallelize it!

Review Topic: Shared Memory Coordination

- Nearby is a pair of routines which sum random numbers in a sequence
- On running the code and timing with increasing numbers of threads, the following are observed

#threads	niters	time(s)	correct?
serial	10mil	8.05	Yes
omp 1	10mil	8.07	Yes
omp 2	10mil	12.32	No
omp 4	10mil	19.71	No
omp 8	10mil	30.68	No

Explain these and how to fix the parallel version

```
long randsum_serial(int niters){
  long sum = 0;
  for(int i=0; i<niters; i++){
    long num = rand();
    sum += num;
  }
  return sum;
}

long randsum_omp(int niters){
  long sum = 0;
  #omp parallel
  {
    for(int i=0; i<niters; i++){
      long num = rand();
      sum += num;
    }
  }
  return sum;
}
```

Review Topic: GPU Thread Sync

A

We have seen that CUDA provides the `__synchthreads()` function to synchronize threads within a thread block.
Why is this function necessary? Give an example where it would be useful.

B

What are the limits to `__syncthreads()`?
Which threads does it synchronize and which threads does it not?
What alternatives are available for thread synchronization?

Review Topic Requests

- Distributed Memory Architecture
- Shared Memory Architecture
- MPI for Distributed Memory Programming
- PThreads + OpenMP for Shared Memory Programming
- CUDA for GPU Programming
- Communication Patterns
  - Broadcast, Scatter/Gather, Reductions
  - Synchronization between procs/threads
- Input/Output Problem Decomposition
- Parallel Problems/Applications
  - Sums, Min/Maxes
  - Matrix Multiplication
  - Solving Linear Systems
  - Sorting
  - Basics of Fluid Dynamics, N-Body simulation, Neural Networks, Crypto Mining

Survey Says ...

SRTs Response Rate

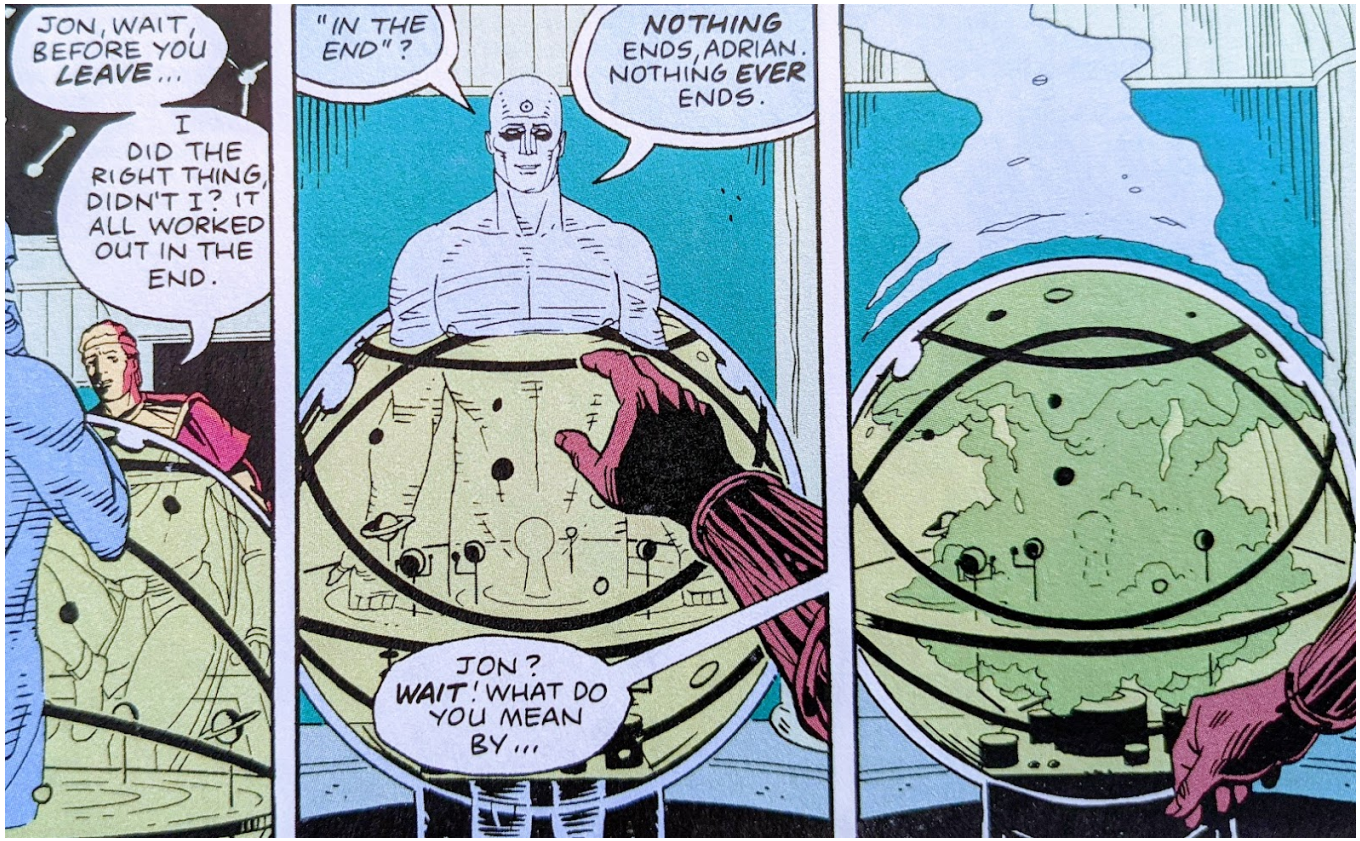
Responded	Invited	%Rate
19	53	35%

If we make it to 80% by Mon 5/2 11:59pm, will add a final exam question here

Final Exam Question

TBD

Nothing Ever Ends



By now you should realize that what you learned

- Will come up again showing whether you learned it well the first time or need another pass.
- Will change in the future and make you feel old.

Expect this and stay stay patient.

Conclusion

It's been a hell of a semester.
I'm proud of all of you.
Keep up the good work.
Stay safe. Happy Hacking.