THE UNIVERSITY of TULSA

Tandy School of Computer Science

Third Annual Oklahoma High Performance Computing Competition

When:
10:00 AM – 3:00 PM, Saturday, April 21, 2018

Where:
Keplinger Hall, The University of Tulsa, Tulsa, OK, 74104, USA

Description:
The competition will have two tracks, focused on programming for high-performance computing on a cluster.

- Uniform hardware, costing approximately $500 - $550
- Teams of 2-4 students

Registration:
Teams may register beginning February 1, 2018.

Teams:
- Eligibility: Students enrolled as a graduate student, undergraduate student, or in a 2-year college. Each team must have at least one faculty advisor. Teams may consist of student members from multiple institutions. Multiple teams from one institution are allowed.
- Team Classification:
  - Graduate Team: At least one graduate student is on the team.
  - Undergraduate Team: At least one undergraduate student is on the team, but no graduate students are on the team.
  - 2-Year College Team: Only students from 2-year institutions.

Contacts:
Peter J. Hawrylak
Email: peter-hawrylak@utulsa.edu

John Hale
Email: john-hale@utulsa.edu

Mauricio Papa
Email: mauricio-papa@utulsa.edu

Schedule:

0930 – 1015 Registration **Keplinger Hall**

1015 – 1030 Opening Remarks and Schedule of Events

1030 – 1130 Setup of Clusters for Tracks 1 & 2 Competition

1130 – 1200 First Run of Competition Programs and Timing Reports (Tracks 1 & 2)

1200 – 1330 Lunch and Networking **Keplinger Hall**
Discuss Approaches to Problems with Other Teams
All Work Stops for Tracks 1 & 2 besides Sharing and Discussion
Short Presentations (3 minutes each) of OneOCII High Performance Computing Research and Educational Opportunities

1330 – 1430 Work on Revising Programs (Tracks 1 & 2)

1430 – 1445 Presentation of Winners **Keplinger Hall**

1445 – 1500 Closing Remarks **Keplinger Hall**

1505 End of Second Annual Oklahoma High Performance Computing Competition

Cluster Hardware Description:

The clusters must meet the following hardware requirements.

- Consist of 8, Raspberry Pi 2 Model B or Pi 3 units
- Consist of 1, 8-port or 16-port unmanaged 10/100Mbps or 1Gbps Ethernet Switch
- Consist of 1, WiFi connection per cluster to the University of Tulsa's (TU's) guest WiFi network. The WiFi connection is optional. All teams must connect to the Internet using TU's guest WiFi network (cell phone is required to receive access code via a text message and a browser is required on the device being connected to TU's guest WiFi) if Internet connectivity is required.
- Raspberry Pi nodes will be connected using Cat-6 cable.
- Each Raspberry Pi node must be powered from a power supply (e.g., not from a laptop computer), but power may be delivered through a USB cable provided no data is transferred over that connection.
- Seven of the Raspberry Pi node will use a 16GB MicroSD card for data storage. One Raspberry Pi will use a 64GB MicroSD card for data storage and this node can be used as a head and/or storage node in the cluster.

Webpage:

Provides information, sample input data sets with answers.

http://morpheus.mcs.utulsa.edu/~papama/hpc/

Problem Description:

Track 1: Finding the Determinant

Track 1 consists of developing a program to find the determinant of a 50,000 by 50,000 element matrix. The GMP library (https://gmplib.org/) might be a good resource for a library that supports large integers and associated operations with large integers. Performance metrics of interest are (1) correct result and (2) fastest wall-clock runtime (e.g., generation of result). Programs generating incorrect results will not be timed.

The input matrices will consist of only 64-bit double (IEEE 754 double) elements. The log(abs(det)), log of the absolute value of the determinant, will be used for large matrices. More information can be found at:

http://morpheus.mcs.utulsa.edu/~papama/hpc/

You may use any method you wish to compute the correct value of the determinant. Documentation of your method is required for the competition and teams are encouraged to share their approaches with other teams during the networking session at lunch (1200 – 1330 hours).

Datasets will be provided on USB Flash drives to teams when they register. There will be three datasets for this track and the results for all three will be recorded. The elements will be stored in row major order starting with upper left element of the matrix. The datasets may include a matrix whose determinant is 0 (zero) or ±infinity.

Teams in Track 1 will be ranked in four categories:

1. Smallest average time for all three cases
2. Best time for Dataset 1
3. Best time for Dataset 2
4. Best time for Dataset 3

Track 2: Traveling Salesperson Problem

Track 2 consists of developing a program to find the a circuit (path) through a group of cities having the minimum cost. This is known as *the traveling salesperson problem* and is an NP-Hard problem. An input matrix will be provided which lists the cost of traveling from city *x* to city *y* as an integer value. Element m_{ij} of the matrix denotes the cost of going from city *i* to city *j*.

A list of circuits will be provided and the goal is to find the shortest path for each circuit in the list within 300 seconds. The program is only allowed to execute for 300 seconds and then must report the results. The reporting of results is not included in the 300 seconds. Loading and distributing the information is included in the 300 seconds. An example of the list of circuits containing three circuits is below.

1,2,3,4,5,6,7,8,9,10\n
3,8,2,5,7,8,12,99,104\n
100,150,250,50,75,10,9,98,8,1\n
end

Teams in Track 2 will be ranked based on sum of the shortest circuit times reported by their program.

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Graduate Study Opportunities for M.S. and Ph.D. at The University of Tulsa's Tandy School of Computer Science

Ph.D. Opportunities:

- **Ph.D. in Computer Science**
- **Ph.D. in Computer Engineering**

M.S. Opportunities:

- **M.S. in Computer Science**
- **M.S. in Computer Engineering**
- **M.S. in Cyber Security**

Joint Degree Options

- **M.S. in Computer Science and a MBA**
- **M.S. in Computer Science and a J.D.**

Information and application are located at:

Information: https://graduate.utulsa.edu/

Application: https://graduate.utulsa.edu/admission/

https://graduate.utulsa.edu/admission/applying/