Dear Friends,

As the snow flies outside and the Holidays are upon us, we’re all left wondering where the fall has gone. In addition to our regular teaching and research activities, some of which are detailed further in this issue, we’ve been busy this semester with a number of new initiatives. The faculty have been working hard to update our undergraduate curriculum and recently put forth a proposal that is currently under review with the University’s Academic Standards & Curriculum Review Committee (ASCRC). This proposal would allow our students more flexibility in choosing among areas of Computer Science that truly interest them while still maintaining a critical core of classes. One aspect of this proposal is the introduction of an Interdisciplinary option whereby students could count up to 12 credits from another major or minor degree towards their CS degree. We think this change would be beneficial for our students, and we hope to be able to roll-out the new curriculum by fall of 2013. We also continue to have an active Lunchtime Lecture series, hosting talks from a wide variety of distinguished guests throughout the year. Finally, we have ramped up our program assessment efforts in preparation for our next ABET accreditation review. Areas of focus include in-class assessment, exit surveys and exams, capstone projects, and help from our advisory board.

We have a wonderful, close-knit group of faculty, staff and students here in Missoula which is thriving. It remains important to us that we keep in touch with our alumni and friends and include them in this community, so please contact us if you are in the area and want to stop by for a visit. We’d love to catch up with you, learn what you’ve been doing, and share some more details about ourselves.

Happy Wintering!

~ Yolanda Reimer
Department Chair

Departmental Updates

This past summer we held our 2nd annual Android Programming Camp for middle school students where we hit our capacity enrollment. We enjoyed spending time with a wonderfully diverse group of students who had fantastic ideas for new and fun games. This year we also started a new Xbox 360 Programming Camp for high school students. Again, we had a number of creative and motivated students, and we look forward to hosting both camps again next year. Thanks to all our volunteers and parents who helped shape this experience into a great success!
In October of 2012 UM CS faculty member Jesse Johnson attended the final meeting of the Greenland Analogue Project in Stockholm, Sweden. Johnson is working with a group of scientists and engineers studying in the long term viability of nuclear waste that is disposed of in deep geological repositories. Such repositories involve tunneling 500 or more yards into solid bedrock, placing copper canisters full of nuclear waste at depth, and finally resealing the tunnel with a clay and rock mixture. Because the time scales of interest are 100,000 or more years, the nuclear waste repositories in Scandinavia and Canada are likely to be disturbed by an ice age. During an ice age, more than half a mile of ice is likely to rest on top of the nuclear waste repository. It is critically important that the canisters storing waste not be exposed to large fluxes of highly oxygenated water.

The flow of glacial ice, and the generation of melt water at the base of a glacier are Johnson's specialties. In this project, the investigators are considering the present day Greenland ice sheet to be very similar to the ice sheets that may someday rest on Canada and Scandinavia. Johnson and others spent the week considering the detailed field data that has been acquired in Greenland as a result of the project. Johnson is attempting to reconcile the results of his numerical models with the new field data. The process has been illuminating. Recently members of Johnson's research group discovered that an important source of heating in the glacier, the latent heat of refreezing near the edge, had been neglected. This discovery is significant for both the modern Greenland ice sheet, as well as nuclear waste disposal.

Dr. Rosulek recently received the prestigious National Science Foundation CAREER grant. Over five years, he will receive $492,588 to continue his research in cryptography, specifically secure multi-party computation. Only six UM faculty members have received CAREER awards in recent years. Congratulations Mike!

Dr. Chen will return to campus for the Fall 2013 semester.

The Computer Science Department would like to congratulate Dr. Chen on the birth of her second daughter! Yasmin was born September 27th at 1:54am in the Seattle area at 7lbs and 20.1”. Both mother and baby are doing great and recuperating with friends and family.

Future Computer Scientist
In the fall of 2012 a small group of undergraduate upper division students (Nicholas Busby, Ryan VanMaele, Mark Daniels, and Josh Austin), decided to investigate whether we could tackle a new computer science topic, and in so doing, receive academic credit toward our degree. Several of us had recently taken a new course in mobile computing and we had this idea that the vast number of mobile computing devices represented an underused computational resource. We approached Dr. Douglas Raiford with the idea of putting together an independent study that would explore this topic, and asked if he would sponsor us. He was receptive to the idea and had us work over the summer to put together a course of study, a list of deliverables, and a timetable on the topic of “Distributed Computing Using Inconsistent Mobile Nodes.”

There are a huge number of smartphones and many of them sit idle for most their daily lives. We wanted to see if we could develop a distributed computing framework that could harness the power of these idle phones. Smartphones are becoming more and more computationally powerful. The Cellular Telecommunications Internet Association (CTIA) estimated in October 2011 that there were 96 million smartphones each with at least one processor. For reference, a well-known distributed computing project, Folding@home, produces $8051 \times 10^{12}$ floating point calculations per second (8051 TerraFLOPS) using 384,241 CPUs. With almost 250 times the number of processors our system could easily exceed these numbers. (continued on next page).
Starting in the fall of 2012 our team began work on the project. We designed the system with four major components. First is the Central Server. This has to control all of the operations. It passes out unfinished jobs, knows what to do with finished jobs, and keeps track of all of the statistics of the system. The statistics include how many jobs are being performed, how fast they are being completed, what devices are doing what work, and what operating systems are doing what work. Behind this Central Server is a database that is a large storage vessel for all of the jobs and statistics. Connected to this database is a website that will be available to the public so that they can see how the system is doing and what trends are present in the system. These three parts are pretty standard for any distributed computing system. Where our system is different is in the mobile nodes. From the beginning the system was designed to run on all three major mobile platforms: Android, iOS, and Windows Phone. Additionally, we imposed a design criterion that our apps would follow the marketplace regulations for all three devices so that we would be able to be published on the public marketplaces of the respective operating systems. To our knowledge, no one has done this before. The other attempts that we have found were only for one of the operating systems and needed to be side-loaded, making it difficult for some users to participate in the system.

As a proof-of-concept our system currently distributes the computation of a couple of known NP-hard problems (the Knapsack problem and the Traveling Salesman problem). A genetic algorithm approach was used for producing solutions to the problems since GA’s are easily parallelizable. The mobile nodes are able to compute the quality (fitness) of a large number of proposed solutions (offspring) in parallel. Genetic algorithms are not new, but having such a huge number of remote nodes at their disposal is. Since our system leverages the power of the massive number of mobile phones worldwide, it can test more potential solutions and possibly provide better answers faster than other systems.
Evan Cummings
Evan is currently an undergraduate computer science and mathematics major doing undergraduate research for Dr. Jesse Johnson.

After high school how did you come to study Computer Science?
In high school I took 4 years of SIMS math. The Sims project in high school was basically working with computers in tandem with pencil and paper to better visualize what you were working on.

My first interest that I wanted to pursue was audio engineering and received a degree in audio production from The Art Institute of Seattle in 2008. When I graduated I owed a lot of money and a lot the positions for audio engineers required computer experience. I really wanted to get a job in audio production in the computer environment so I decided to go back to school and get a degree in computer science – my other main interest.

When did you first get interested in Computer Science?
I think my high GPA is a factor of taking a lot of time to get things done. I don’t think of myself as smart. I have a good work ethic. I wanted to do a good job when I worked. I felt a connection and cared about doing a good job. I am fairly obsessive compulsive - I have to get it done as perfectly as possible. When I was working a job that wasn’t much fun to do, I’d do it just because I didn’t want to do it. Some of the other employees would skip the task and no one would care, even the boss. I felt that it was important for me to be able to do a thing that I didn’t want to do, and do it as best I could.

I really enjoyed Jesse’s visualization course because he allowed me creative freedom. I was intrinsically motivated and had fun doing the homework. I like math and other subjects I didn’t like before because I forced myself to learn as much about it that I can. It may be that I come to the point where I see the subject’s inner beauty; then I become intrinsically instead of extrinsically motivated to learn the subject. It’s at this point the experience becomes very rewarding.

How did you first become interested in computers?
I first got interested in computers around 1988. I was 8 years old and my family had an Intel 8088 processor which could display at most 3 colors to the screen. I liked playing games like Rocky’s boots: you would complete a virtual circuit diagram that when complete would shoot electricity and power a virtual object, like wind in a boat sail. I also liked a game called LHX - an experimental helicopter game in 3D; this was a big deal for the time because most games were 2D. My neighbors during this time had an Amiga with many more instantaneous colors, faster processor, and a plethora of really good games. It was all about games when I was a kid, and to some extent still is.

My parents were big advocates of computers; they liked the fact that you could learn and interact with them rather than just watching the TV. I built my first computer in the late 90’s. It was a CYRIX 586 (an off brand of Intel) with a 4-speed CD-ROM. It was fast! I played Quake 1 online multiplayer death matches all night long.

Tell us a little bit about your undergraduate research.
I am an undergraduate researcher for Jesse Johnson. I work with his Snow, Ice, and Climate Group researching how the top layer of snow on an ice sheet or glacier becomes more dense over time. The group takes measurements of the Greenland ice sheet and makes predictions on ice sheet conditions – taking core samples and such. The work I do is really fun and a big challenge. At first it was hard to see how I could accomplish the task and was doubtful that I could handle it - It really sparked my curiosity. I enjoyed the challenge of beginning with nothing more than a system of equations and creating a model of this system in the computer environment. At times it doesn’t feel like work, but more like playing a game. The difference is that I’m playing a game that can possibly contribute something useful for others. The simulation I helped create is just another piece to the puzzle of glacial mechanics.
Kyle Doyle
Kyle is a senior undergraduate student, research assistant, and tutor.

Do you see yourself as a scientist?
I see myself as on the way there. I think science is expanding things in your field and I believe I am starting to do that.

What undergrad research have you participated in?
In the math department I worked on topology, which is not exactly theory, but it does get mind boggling theoretically but can turn into something useful.

I also work with Dr. Johnson modeling ice sheets. Modeling the real world is interesting because it is closer to physical science than theory.

I also participated in the Global Networks Operations Center in Indiana this summer.

How was your time in Indiana?
My role was in a fairly basic internship research position on networking technology. Half our time was in lectures on networking and half was spent on hands on projects. The people were interesting, most were from Indiana. Clinton McKay and I were from the farthest away.

The facility was a data center with racks of hundreds of servers. Universities need terabytes of data. They have scientific applications that take up huge amounts of data that needs to be transferred.

I most enjoyed learning about networking from fiber optics to organizing and setting up a network. The hands-on aspects were the most fun for me.

What are your plans for after you finish your undergraduate coursework?
I will most likely go on to do a Master’s and PhD. Not sure what things will be like in the future.
Tyler Davis

Tyler is a senior, and will be graduating with physics and CS degrees in the spring.

How did you decide to pursue a major in Computer Science?
My high school offered two years of CS classes, so I took those. We started programming with TI-83 calculators and then moved on to Java.

I ended up doing an independent study and made a board game, which really led me to pursue CS after high school.

What are your plans after finishing up your undergraduate degrees?
I most definitely want to go to grad school. I haven’t quite narrowed it down to exactly what I want to do. I might apply to the CS master’s program here. I also am thinking about doing an engineering or physics masters. Maybe even electrical engineering. I really like modeling systems, so I’d like to find a program that focuses on that. I think my CS experience will help out a lot.

What was your favorite CS class?
I really enjoyed Mike’s (Rosulek) Algorithms and Design class. It was an interesting class and helped a lot to develop critical thinking skills. I would say that and abstract math are two classes I’ve taken that have helped me become a better problem solver.

Do you have any programming projects you do for fun?
A friend and I began to design a browser game over the summer. It was pretty easy and all in javascript. It had a lot of built in collision detection so we could focus on the actual gameplay. It’s hard to find time to do fun projects during school, so hopefully in the future we can pick it up again.

How did your physics background help in Computer Science?
I really felt like it helped in my research with Dr. Johnson. There was a lot of math, especially partial differential equations. I had already used PDEs to model a lot in physics so I was able to pick it up a little bit easier.

Did you find the reverse to be true? Has CS helped in your physics classes?
Most definitely. When I took various astronomy labs we dealt with plots of data all the time. I learned Python in Dr. Johnson’s modeling class so that helped out a lot. Most of the other students were actually asking me for help.
Donations to the department can be made through the UM Foundation at The University of Montana Foundation, P.O. Box 7159, Missoula, MT 59807-7159, or online at http://www.umt.edu/UMF/.

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