Oregon Health & Science University  
Department of Medical Informatics and Clinical Epidemiology  
*BMI 565/665*  
Bioinformatics Programming and Scripting  
Fall Term 2015  
Tuesdays and Thursdays 9:00am-10:25am, BICC 124

**Instructor:** Michael Mooney, Ph.D. ([mooneymi@ohsu.edu](mailto:mooneymi@ohsu.edu))

**Teaching Assistant:** Ryan Swan ([swanr@ohsu.edu](mailto:swanr@ohsu.edu))

**Office Hours:** by appointment


**Other Resources:**
- Google's Python Class, [https://developers.google.com/edu/python/](https://developers.google.com/edu/python/)
- Problem Solving with Algorithms and Data Structures Using Python by Brad Miller and David Ranum, [http://interactivepython.org/courselib/static/pythonds/index.html](http://interactivepython.org/courselib/static/pythonds/index.html)
- Python Cookbook by David Beazley and Brian K. Jones, [http://chimera.labs.oreilly.com/books/1230000000393](http://chimera.labs.oreilly.com/books/1230000000393)
- Python for Data Analysis by Wes McKinney, O'Reilly Media, 2012

**Course Description:** The purpose of this course is to equip research scientists with computational skills necessary to create and automate tools to analyze biological data. The course is divided into four sub-topics: Python programming, scripting in Unix/Linux, the BioPython library, and bioinformatics workflows. Python will be used to solve simple to sophisticated programming problems and to review general programming language paradigms such as problem abstraction, data types, file I/O, iteration, functions, and objects. There will also be an emphasis on writing Unix/Linux operating system shell scripts to automate repetitive tasks and connect disparate bioinformatics tools using files and pipes. In addition, students will learn to access public repositories to perform basic bioinformatics tasks such as annotating gene products, sequence searching, and functional queries. This course is designed to be a first year requirement for students in the Bioinformatics and Computational Biology graduate program in Biomedical Informatics.

**Course Objectives:**
- **Working with Problems Algorithmically:** Be able to create and automate bioinformatics tasks using a high level programming language.
- **Working with Pipelines:** Using scripting in a Linux operating system to execute and connect previously written bioinformatics tools in a workflow
- **Working with Files and Public Repositories:** Read and write text data from files and access data and annotation from common bioinformatics public repositories.
- **Working with Bioinformatics Data:** Be able to perform basic data processing tasks and create a graphical representation of results.
**Prerequisites:**
Background must include an introductory programming class including concepts such as data types, loops, I/O, functions, and basic algorithms.

**Course Grading Policy:**
Grades will be based on scores from examinations, weekly programming assignments, and a final research project. The point breakdown is as follows:
- Programming Assignments: 40%
- Research Project: 20%
- Mid-Term Exam: 20%
- Final Exam: 20%

Programming assignments will be handed out each Tuesday and will be due the following Tuesday at 5:00pm. Late assignments will be penalized. Research projects will involve the analysis of a high throughput dataset over the last 2 weeks of class and will require a 3 page write-up. Assignments should be submitted through Sakai.

Graduate Studies in the OHSU School of Medicine is committed to providing grades to students in a timely manner. Course instructors will provide students with information in writing at the beginning of each course that describes the grading policies and procedures including but not limited to evaluation criteria, expected time needed to grade individual student examinations and type of feedback they will provide.

Class grades are due to the Registrar by the Friday following the week of finals. However, on those occasions when a grade has not been submitted by the deadline, the following procedure shall be followed:

1) The Department\(^1\) /Program Coordinator\(^2\) will immediately contact the Instructor requesting the missing grade, with a copy to the Program Director and Registrar.
2) If the grade is still overdue by the end of next week, the Department\(^1\) /Program Coordinator\(^2\) will email the Department Chair directly, with a copy to the Instructor and Program Director requesting resolution of the missing grade.
3) If, after an additional week the grade is still outstanding, the student or Department\(^1\) /Program Coordinator\(^2\) may petition the Office of Graduate students for final resolution.

\(^1\) For courses that are run by a specific department.
\(^2\) For the conjoined courses (course number is preceded by CON_ that are run by Graduate Studies.

**Attendance policy:**
If possible...don’t miss class! Consider getting notes from a kind fellow student.

**Tentative Class Schedule:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29-Sep</td>
<td>Intro, Computing Resources, Linux Basics, Installation Python: Help/Documentation, Coding Best Practices, Data Types, Operators In the book (Bassi): Chapters 1, 2, 3, pp. 112, 393-408, 464-478 Python/Linux Tutorial</td>
</tr>
<tr>
<td>1</td>
<td>1-Oct</td>
<td>Python: Control Structures, File I/O In the book: Chapters 3, 4, 5, pp. 476-477</td>
</tr>
<tr>
<td>2</td>
<td>6-Oct</td>
<td>Python: Functions, Generators, OOP, and Modules</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>8-Oct</td>
<td>In the book: Chapters 6, 8 Python: Linux/Unix Commands, Bash Scripting</td>
<td></td>
</tr>
<tr>
<td>13-Oct</td>
<td>Python: Bash continued, Regular Expressions</td>
<td></td>
</tr>
<tr>
<td>15-Oct</td>
<td>Python: XML</td>
<td></td>
</tr>
<tr>
<td>20-Oct</td>
<td>Python: HTML, Web Scraping</td>
<td></td>
</tr>
<tr>
<td>22-Oct</td>
<td>BioPython: Entrez E-Utils</td>
<td></td>
</tr>
<tr>
<td>27-Oct</td>
<td>In the book: Chapter 9 Python: Graph Data Structures (NetworkX), Intro to Graph Algorithms</td>
<td></td>
</tr>
<tr>
<td>29-Oct</td>
<td>Python: Graph Algorithms, Algorithm Analysis</td>
<td></td>
</tr>
<tr>
<td>3-Nov</td>
<td>Python: Error Handling, Exceptions, Code Testing, Exam Review</td>
<td></td>
</tr>
<tr>
<td>5-Nov</td>
<td>Mid-term Exam</td>
<td></td>
</tr>
<tr>
<td>10-Nov</td>
<td>BioPython: seqRecords, seqIO, Alignments, alignIO</td>
<td></td>
</tr>
<tr>
<td>10-Nov</td>
<td>BioPython Tutorial</td>
<td></td>
</tr>
<tr>
<td>12-Nov</td>
<td>BioPython: BLAST</td>
<td></td>
</tr>
<tr>
<td>12-Nov</td>
<td>Research Project Assigned</td>
<td></td>
</tr>
<tr>
<td>17-Nov</td>
<td>Python: NumPy, matplotlib</td>
<td></td>
</tr>
<tr>
<td>19-Nov</td>
<td>Python: Statistics with Pandas, Statsmodels</td>
<td></td>
</tr>
<tr>
<td>24-Nov</td>
<td>Thanksgiving Break</td>
<td></td>
</tr>
<tr>
<td>26-Nov</td>
<td>Thanksgiving Break</td>
<td></td>
</tr>
<tr>
<td>1-Dec</td>
<td>Python: Statistics and Machine Learning with SciPy, scikit-learn</td>
<td></td>
</tr>
<tr>
<td>3-Dec</td>
<td>Python: scikit-learn continued, Image Analysis</td>
<td></td>
</tr>
<tr>
<td>8-Dec</td>
<td>Python: Image Analysis continued, Parallel Processing, Exam Review</td>
<td></td>
</tr>
<tr>
<td>10-Dec</td>
<td>Final Exam</td>
<td></td>
</tr>
</tbody>
</table>

**Student Access:**

OHSU is committed to providing equal access to qualified students who experience a disability in compliance with Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990, and the ADA Amendments Act (ADA-AA) of 2008. If you have a disability or think you may have a disability (physical, sensory, chronic health, psychological, learning, or other) please contact the Office for Student Access at (503) 494-0082 or studentaccess@ohsu.edu to discuss eligibility for academic accommodations. Information is also available at www.ohsu.edu/student-access. Because accommodations may take time to implement and cannot be applied retroactively, it is important to have this discussion as soon as possible. All information regarding a student’s disability is kept in accordance with relevant state and federal laws.

**Academic Integrity:**

The students will be responsible for following the OHSU guidelines for academic integrity. You may discuss the general concepts and principles behind an assignment with other students. In fact, you are encouraged to do this whenever possible, because it is often a valuable way to reinforce
ideas, and to learn new perspectives. However, in doing assignments, each student is expected to develop, write up, and hand in an individual solution and, in doing so, develop a sufficient understanding of the problem and solution so as to be able to explain it adequately to the instructor. Under no circumstances should a student copy or consult the solution of another student, or copy a solution from any other source, including the Internet.

Literature and resources (including Internet resources) employed in fulfilling assignments must be cited. See http://www.ohsu.edu/xd/education/library/research-assistance/plagiarism.cfm?WT_rank=1# for information on code of conduct for OHSU and http://www.ohsu.edu/xd/education/teaching-and-learning-center/for-students/index.cfm for more information on citing sources and recognizing plagiarism.

**Copyright Information**

Every reasonable effort has been made to protect the copyright requirements of materials used in this course. Class participants are warned not to copy, audio, or videotape in violation of copyright laws. Journal articles will be kept on reserve at the library or online for student access. Copyright law does allow for making one personal copy of each article from the original article. This limit also applies to electronic sources.

To comply with the fair use doctrine of the US copyright law, Sakai course sites close three weeks after grades are posted with the Registrar. Please be sure to download all course material you wish to keep before this time as you will have no further access to your courses.

**Use of Sakai**

This course will have an online component, which can be accessed through Sakai, OHSU’s online course management system. For any technical questions or if you need help logging in, please contact the Sakai Help Desk.

Hours: Sakai Help Desk is available Mon – Fri, 8 am – 9pm and weekends and holidays 12 pm – 5 pm (closed on official OHSU holidays).

Contact Information:
(Local) 503-494-7074 (4-7074 on campus)
(Toll-free) 877-972-5249
(Web) http://atech.ohsu.edu/help
(Email) sakai@ohsu.edu

**Inclement Weather Policy**

When the weather forecaster is calling for ice or snow, call the OHSU Alert Line, 503 494-9021, for information regarding weather conditions that may affect operations at OHSU. This hot line will offer specific recorded messages for road conditions on OHSU’s Marquam Hill and West campuses (option 1), and for patients (option 2), students (option 3) and employees (option 4).

If extreme weather conditions present potentially unsafe situations, the provost of the university may choose to delay or cancel classes, or alter office and research activities. If classes are canceled or delayed, residents and students who have patient care responsibilities must meet those obligations.

For more information, please view the website http://www.ohsu.edu/xd/about/visiting/weather/index.cfm or call the above hotline.
DMICE COMMUNICATION POLICY

1. If the syllabus directs the student to contact the TA before contacting the instructor, the student should do so. Otherwise, the student should contact the instructor and allow 2 business days (not including weekends) for a response.

2. If the student does not receive a response from the instructor within 2 business days, s/he should contact the TA (if there is one). When contacting the TA s/he should cc the instructor and Diane Doctor at doctord@ohsu.edu.

3. If a student does not receive a response from the TA within 1 business day (not including weekends), s/he should contact Diane Doctor at doctord@ohsu.edu and cc the instructor and the TA.

4. If Diane does not reply within 1 business day (not including weekends), the student should contact Andrea Ilg at ilgan@ohsu.edu.

5. Students having difficulties with Sakai should contact the Sakai Help Desk at sakai@ohsu.edu or at (877) 972-5249. Sakai help is available M-F from 8am to 10-pm and weekends from Noon to 5pm. Do not contact the instructor.