

**BMI 226 / CS 426 – Fall 2003 – APPROXIMATE SCHEDULE –Version A**

The deadlines for selecting project and turning In project will not change. The deadlines for problem sets are unlikely to change. The rest of the schedule is subject to change (especially in the second half). Updated versions will be circulated during the course.

	<b>2003</b>	<b>Reading Assignments (To Be Read PRIOR to Lecture)</b>	<b>Lecture Items</b>
1	<b>W- Sept 24, 2003</b>	---	<ul style="list-style-type: none"> <li>• Description of genetic algorithm (GA) and genetic programming (GP)</li> <li>• Overview of field</li> <li>• Course administration</li> </ul>
2	<b>M – Sept 29</b>	<ul style="list-style-type: none"> <li>• Read GASOML, Ch 1</li> <li>• Read GASOML, Ch 2, Pages 27-54</li> </ul>	<ul style="list-style-type: none"> <li>• Flowchart of GA</li> <li>• Preparatory steps for GA</li> <li>• 10-member truss example</li> <li>• Wire antenna example</li> <li>• Artificial ant problem using GA to find finite state automata</li> <li>• Artificial ant using GA to find neural net</li> <li>• Iterated prisoner's dilemma with GA to find finite state automata</li> <li>• Evolution of Communication (GA)</li> </ul>
3	<b>W – Oct 1</b>	<ul style="list-style-type: none"> <li>• <b>PROBLEM SET NO. 1 DUE</b></li> <li>• Read GP, Part of Ch 3, Pages 17-59</li> </ul>	<ul style="list-style-type: none"> <li>• GA Hamburger example</li> <li>• Schema</li> <li>• Schema theorem</li> <li>• Schema non-linear equations for GA</li> <li>• Variable length string GAs</li> </ul>
4	<b>M – Oct 6</b>	<ul style="list-style-type: none"> <li>• <b>PROBLEM SET NO. 2 DUE</b></li> <li>• Read GP, Ch 5, pages 73-77</li> <li>• Read GP, parts of Ch 6, pages 79-104 and 113-116</li> <li>• Read GP, Ch 7, pages 121-147 (cart centering)</li> <li>• Skim GP, part of Ch 4, pages 68-70 (background on LISP)</li> <li>• <b>START MEETINGS WITH JK ON SELECTION AND APPROVAL OF PROPOSED PROJECTS</b></li> </ul>	<ul style="list-style-type: none"> <li>• Intro to Genetic Programming (GP)</li> <li>• Symbolic regression of polynomial, Boolean 11-multiplexer (GP)</li> <li>• Cart centering problem (GP)</li> <li>• Parts of <i>Genetic Programming: The Movie</i></li> <li>• Artificial Ant problem using GP</li> <li>• Discussion of how to select project</li> </ul>
5	<b>W – Oct 8</b>	<ul style="list-style-type: none"> <li>• Read GASOML, Ch 3</li> <li>• Read GP, Ch 7, pages 147–190 (artificial ant using GP, symbolic regression of polynomial, Boolean 11-multiplexer)</li> </ul>	<ul style="list-style-type: none"> <li>• GENESIS software in C for GA</li> <li>• Goldberg's SGA software</li> <li>• Various GA Applications</li> <li>• GA Hamming cliff and Gray code</li> <li>• GP Constrained Syntactic Structures (strong typing)</li> <li>• GP Automatically Defined Functions (ADFs)</li> <li>• Parts of <i>Genetic Programming II Videotape: The Next Generation</i></li> </ul>
6	<b>M – Oct 13</b>	<ul style="list-style-type: none"> <li>• <b>PROBLEM SET NO. 3 DUE</b></li> <li>• Read GP, Appendix B, pages 705-733</li> </ul>	<ul style="list-style-type: none"> <li>• "Little LISP" code for GP</li> <li>• GP software in C</li> </ul>

7	<b>W – Oct 15</b>	<ul style="list-style-type: none"> <li>• Skim Goldberg GASOML, Pages 99-120, 126-129, and 136-142 in chapter 4 (Applications)</li> <li>• Read GP, Ch 10 (Symbolic Regression)</li> <li>• Read GP, Ch 11 (Control and Optimization)</li> </ul>	<ul style="list-style-type: none"> <li>• Symbolic Regression (GP-Ch 10)</li> <li>• Application of GP to control problems (cart centering, broom balancing, truck backer upper, and lizard optimization),</li> <li>• Parts of <i>Genetic Programming II Videotape: The Next Generation</i></li> </ul>
8	<b>M – Oct 20</b>	<ul style="list-style-type: none"> <li>• <b>PROBLEM SET NO. 4 DUE</b></li> <li>• Skim GP, Ch 19 (Constrained Syntactic Structures)</li> <li>• Read GP, Ch 20 and 21 (ADFs)</li> <li>• Skim GP, Ch 12 (Emergent Behavior)</li> </ul>	<ul style="list-style-type: none"> <li>• Parts of <i>Genetic Programming II Videotape: The Next Generation</i></li> <li>• Emergent behavior using GP</li> <li>• Cellular Encoding of Neural Networks (developmental GP)</li> </ul>
9	<b>W – Oct 22</b>	<ul style="list-style-type: none"> <li>• <b>ALL PROJECT PROPOSALS APPROVED – TURN IN 1-PAGE PROJECT SUMMARY SHEET ON PAPER OR BY E-MAIL</b></li> <li>• Read GP, Ch 8 (Computational Effort)</li> </ul>	<ul style="list-style-type: none"> <li>• Computational Effort</li> <li>• Time-Saving techniques and other practical aspects of GA and GP programming</li> <li>• Common mistakes in applying GAs</li> <li>• Art of applying Gas</li> <li>• Discussion of how to do project and how to write up project</li> </ul>
10	<b>M – Oct 27</b>	<ul style="list-style-type: none"> <li>• Read Koza <u>Hand-Out</u> on transmembrane domains</li> </ul>	<ul style="list-style-type: none"> <li>• Biological motivations for GAs</li> <li>• GA and GP applications to molecular biology</li> <li>• Transmembrane segment identification problem</li> <li>• Iteration and recursion</li> </ul>
11	<b>W – Oct 29</b>	<ul style="list-style-type: none"> <li>• Read Koza et al. <u>Hand-Out</u> on automated synthesis of analog electrical circuits</li> </ul>	<ul style="list-style-type: none"> <li>• Automated synthesis of topology and sizing for analog electrical circuits</li> <li>• Kruiskamp GA for evolving op amp</li> <li>• <i>Genetic Programming III Videotape: Human-Competitive Machine Intelligence</i> (45 minutes)</li> </ul>
12	<b>M – Nov 3</b>	<ul style="list-style-type: none"> <li>• Read Koza <u>Hand-Out</u> on gene duplication and architecture-altering operations</li> </ul>	<ul style="list-style-type: none"> <li>• Architecture-altering operations for the evolution of architecture for multi-part programs in GP</li> </ul>
13	<b>W – Nov 5</b>	<ul style="list-style-type: none"> <li>• Read Koza et al. <u>Hand-Out</u> on automated synthesis of controllers</li> </ul>	<ul style="list-style-type: none"> <li>• Automated synthesis of controllers</li> <li>• Parameterized topologies for circuits</li> <li>• Parameterized topologies for controllers</li> </ul>
14	<b>M – Nov 10</b>	<ul style="list-style-type: none"> <li>• Skim GP, Ch 22 (Parallelization)</li> <li>• Skim Goldberg GASOML, Ch 5, Pages 208-212</li> </ul>	<ul style="list-style-type: none"> <li>• Parallelization of GAs</li> <li>• Parallelization of GA and GP</li> </ul>
15	<b>W – Nov 12</b>	<ul style="list-style-type: none"> <li>• Read Koza et. al. <u>Hand-Out</u> on evolvable hardware (EH) using field-programmable gate arrays (FPGAs)</li> </ul>	<ul style="list-style-type: none"> <li>• Evolvable hardware (EH) using field-programmable gate arrays (FPGAs)</li> <li>• Evolvable hardware (EH) applications</li> </ul>
16	<b>W – Nov 17</b>	<ul style="list-style-type: none"> <li>• Read Goldberg GASOML, Ch 6 (Classifier Systems)</li> <li>• Skim Goldberg GASOML, Ch 7 (Classifier Systems Applications)</li> <li>• Skim GP, Ch 13 (Evolution of Subsumption)</li> </ul>	<ul style="list-style-type: none"> <li>• Classifier systems</li> <li>• SCS computer implementation</li> <li>• Classifier systems applications</li> <li>• Hierarchical credit allocation</li> <li>• Parallelization of Classifier Systems (Robertson)</li> <li>• Default hierarchies</li> <li>• Evolution of subsumption using GP</li> </ul>

17	<b>M – Nov 24</b>	<ul style="list-style-type: none"> <li>• Skim GP, Ch 14 (Entropy)</li> </ul>	<ul style="list-style-type: none"> <li>• Automated synthesis of topology, sizing, placement, and routing of electrical circuits</li> <li>• Entropy-driven evolution of cellular automata randomizers using GP</li> </ul>
18	<b>W – Nov 26</b>	<ul style="list-style-type: none"> <li>• Read <u>Hand-Out</u> on evolution of assembly code</li> </ul>	<ul style="list-style-type: none"> <li>• Evolution of assembly code</li> <li>• Linear genome GP</li> </ul>
19	<b>M – Dec 1</b>	<ul style="list-style-type: none"> <li>• Skim GP, Ch 27 (Comparison of ML techniques)</li> <li>• Skim GP, Ch 26 (Review of GP)</li> </ul>	<ul style="list-style-type: none"> <li>• Various search and machine learning paradigms</li> <li>• Simulated annealing</li> <li>• Decision trees</li> <li>• Evolutionary programming, evolution strategies</li> <li>• Current research on GA</li> <li>• Current research on GP</li> </ul>
20	<b>W – Dec 3, 2003</b>	<ul style="list-style-type: none"> <li>• <b>Last meeting of class</b></li> <li>• <b>PROJECTS DUE –3:15 PM – <u>No extensions!!!</u></b></li> <li>• <b>TAKE-HOME FINAL DISTIRBUTED during class</b></li> </ul>	<ul style="list-style-type: none"> <li>• Summary</li> <li>• <b>COURSE EVALUATION FORMS</b></li> </ul>
	<b>W – Dec 10, 2003</b>	<ul style="list-style-type: none"> <li>• <b>TAKE-HOME FINAL DUE – 3:15 PM</b></li> </ul>	