

# **Penn State Harrisburg Computer Science**

## **Integrated Undergraduate-Graduate (IUG) Degree Student Handbook 2013-2014**

**For Students Admitted to the Undergraduate Program in Summer 2013 or Later**

Computer Science Program  
School of Science, Engineering, and Technology  
Penn State Harrisburg

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The information provided by this document is subject to change without notice and does not constitute a contract between The Pennsylvania State University and a student or an applicant for admission.

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## I. INTRODUCTION

The Computer Science program offers a limited number of academically superior Bachelor of Science candidates the opportunity to enroll in an integrated, continuous program of study leading to both the Bachelor of Science and the Master of Science in Computer Science. The ability to coordinate as well as concurrently pursue the two degree programs enables the student to earn the two degrees in five years.

## II. APPLICATION PROCESS

To initiate the application process, students must first submit a completed Computer Science IUG Application Form, a transcript, and a plan of study. A faculty adviser will help undergraduate candidates determine a sequence of courses that will prepare them for acceptance into the IUG degree program. In order to apply for the IUG program, students must have completed a minimum of 45 credits and be enrolled in Penn State Harrisburg's Computer Science B.S. program. A typical student would apply after completing between 45 to 60 credits, that is, after the fourth semester and before the end of the fifth semester. For consideration for acceptance into the program, students must have completed and earned a minimum grade point average of 3.0 in the following Computer Science and Mathematics courses:

- 2 semesters of Calculus (Math 140, Math 141)
- 1 semester of Matrices (Math 220)
- 2 semesters of Programming Courses (CMPSC 121, CMPSC 122)
- 1 semester of Discrete Mathematics (CMPSC 360)

To formally apply, students must also complete a Graduate School application. The student should mention in the notes section that the application is for the IUG program in Computer Science. The GRE exam is not required for admission into the program; however, if a student is interested in a graduate assistantship, GRE scores should be submitted before the beginning of the 8<sup>th</sup> semester.

Applications will be evaluated based on overall academic performance, in addition to the above requirements. **In all cases, admission to the program will be at the discretion of the Graduate Admissions Committee in Computer Science.**

### **Reduced Course Load**

As many as 12 of the credits required for the master's degree may be applied to both undergraduate and graduate degree programs. A minimum of 50 percent of the courses proposed to count for both degrees must be at the 500 level. Thesis credits may not be double counted. As

shown in Table 1 below, the Integrated Undergraduate-Graduate Program reduces the total number of credits needed to earn these degrees from 150 to 138.

**Table 1: Credit Requirements for Bachelor of Science and Master of Science Degrees when Pursued Separately and when Pursued in the Integrated Program**

Degree	Total Credits Required
Bachelor of Science in Computer Science	120
Master of Science in Computer Science	30
<b>Separate Bachelor of Science and Master of Science in Computer Science</b>	<b>150</b>
<b>Integrated Bachelor of Science and Master of Science in Computer Science</b>	<b>138</b>

### **Eligibility for a Graduate Assistantship**

Students in the IUG program will be eligible for consideration for a graduate assistantship to be awarded beginning the fifth year. To be eligible for a graduate assistantship, students must have completed the requirements for their B.S. degree. The GRE exam is not required for admission into the program; however, if a student is interested in being considered for a graduate assistantship, GRE scores must be submitted before the beginning of the 8<sup>th</sup> semester.

### **Tuition Charges**

Undergraduate tuition rates will apply as long as the student is an undergraduate (i.e., the baccalaureate degree has not been conferred), unless the student receives graduate study financial support, for example, an assistantship requiring the payment of graduate tuition.

## **III. IUG DEGREE REQUIREMENTS**

Students in the IUG program must satisfy the requirements for both the Bachelor of Science and Master of Science degrees, as listed in Appendix A and Appendix C. As outlined in the *Reduced Course Load* section above, the total course load is reduced due to courses that can count towards both degrees. The first two years of the IUG program are identical to the first two years of the Bachelor of Science program, which is listed in Appendix B. The third year of the IUG program differs from the third year of the Bachelor of Science program due to a change in the order in which courses are normally taken. The fourth year of the IUG program differs from the fourth year of the Bachelor of Science program because of the inclusion of courses that count toward the Master of Science degree requirements.

Typical schedules for both the paper option and the thesis option are shown below. In the schedule, courses shown in bold satisfy requirements for both the undergraduate and graduate program. As described in Appendix C, in order to satisfy the Master of Science Degree requirements, students must choose either a paper option or a thesis option.

### *Paper Option*

	Fall		Spring	
<b>Junior Year (3<sup>rd</sup>)</b>	CMPSC 462	3	CMPSC 430	3
	STAT 301, MATH 318, or STAT 318	3	CMPSC 463	3
	ENGL 202C	3	CMPSC 469	3
	100-400 level general elective	3-5	300-400 level general elective	3
	300-400 level general elective	3	Approved 400-level elective	3
	<b>Total</b>	<b>15-17</b>		<b>15</b>
<b>Senior Year (4<sup>th</sup>)</b>	CMPSC 470	3	CMPSC 460	3
	CMPSC 472	3	CMPSC 488	3
	CMPSC 487W	3	<b>Approved 500-level elective *</b>	<b>3</b>
	<b>Approved 400-level elective *</b>	<b>3</b>	<b>COMP 511 or 512 *</b>	<b>3</b>
	<b>COMP 505 or 519 *</b>	<b>3</b>		
	<b>Total</b>	<b>15</b>		<b>12</b>
<b>Graduate Year (5<sup>th</sup>)</b>	COMP 505 or 519	3	COMP 511 or 512	3
	COMP 594	3	Approved 500-level elective	3
	Approved 500-level elective	3	Approved 400/500-level elective	3
	<b>Total</b>	<b>9</b>		<b>9</b>

\* Satisfies requirements for both the undergraduate and graduate program

### *Thesis Option*

	Fall		Spring	
<b>Junior Year (3<sup>rd</sup>)</b>	CMPSC 462	3	CMPSC 430	3
	STAT 301, MATH 318, or STAT 318	3	CMPSC 463	3
	ENGL 202C	3	CMPSC 469	3
	100-400 level general elective	3	300-400 level general elective	3
	300-400 level general elective	3	Approved 400-level elective	3
	<b>Total</b>	<b>15-17</b>		<b>15</b>
<b>Senior Year (4<sup>th</sup>)</b>	CMPSC 470	3	CMPSC 460	3
	CMPSC 472	3	CMPSC 488	3
	CMPSC 487W	3	<b>COMP 511 or 512 *</b>	<b>3</b>
	<b>Approved 400-level elective *</b>	<b>3</b>	COMP 600	3
	<b>COMP 505 or 519 *</b>	<b>3</b>		
	<b>Total</b>	<b>15</b>		<b>12</b>
<b>Graduate Year (5<sup>th</sup>)</b>	<b>COMP 505 or 519*</b>	3	COMP 511 or 512	3
	COMP 600	3	Approved 400/500-level elective	3
	Approved 500-level elective	3	Approved 400/500-level elective	3
	<b>Total</b>	<b>9</b>		<b>9</b>

\* Satisfies requirements for both the undergraduate and graduate program

**A minimum grade point average of 3.5 must be earned in all math and computer science course work that is applied toward the graduate degree.** This includes any courses that count toward both the undergraduate and graduate degrees, as well as all courses taken during the fifth year.

Student performance will be monitored on an on-going basis. In addition, a formal evaluation of student academic performance will be performed when the student has completed 100 to 105 credits, which is at the end of the first semester of the senior year for a typical student in the program. Students who have not maintained a 3.5 GPA in their Math and Computer Science courses will be put on probationary status with respect to the IUG program. Their ability to continue in the IUG program will be based on their academic performance in the last semester of their senior year.

As part of the review in the senior year, students will be advised about the paper option and thesis option in the graduate program. Students intending to pursue the thesis option would be advised to do so only if they have been doing very well in the program and are in no danger of not being able to continue into the fifth year.

Students have the choice of receiving the B.S. degree at the end of the fourth year or waiting until the end of the fifth year to receive both degrees. Students who elect to receive the B.S. degree at the end of the fourth year will pay graduate tuition for courses taken in the fifth year; students opting to receive both degrees at the end of the fifth year will pay undergraduate tuition for all five years. Note that students who are awarded a graduate assistantship must satisfy all requirements for the B.S. degree at the end of the fourth year.

If for any reason a student admitted to the IUG program is unable to complete the requirements for the Master of Science degree, the student will be permitted to receive the Bachelor of Science degree assuming all the undergraduate degree requirements have been satisfactorily completed. If the student successfully completes courses listed in the recommended schedule, they will satisfy the requirements for the Bachelor of Science degree by the end of their fourth year.

## Appendix A: Bachelor of Science Degree Requirements

Note: All courses are 3 credits unless otherwise noted. As noted earlier, twelve credits in the Integrated Program can apply to both the Bachelor of Science degree and the Master of Science degree. Refer to the *Reduced Course Load* portion of Section II for more details.

### General Education & Entrance to Major Requirements (55 credits)

- **English** (9 credits)

ENGL 015 [GWS] Rhetoric and Composition (3 credits) or ENGL 030 [GWS]  
ENGL 202C [GWS] Effective Writing: Technical Writing (3 credits)  
CAS 100 [GWS] Effective Speech (3 credits)

- **Mathematics** (10 credits)

MATH 140\* [GQ] Calculus With Analytic Geometry I (4 credits)  
MATH 141\* [GQ] Calculus with Analytic Geometry II (4 credits)  
MATH 220 [GQ] Matrices (2 credits)

- **Computer Science** (6 credits)

CMPSC 121\* [GQ] Introduction to Programming Techniques (3 credits)  
CMPSC 122\* Intermediate Programming (3 credits)

- **Natural Sciences**

PHYS 211 [GN] General Physics: Mechanics (4 credits)  
Additional 5 credits of any courses with a GN suffix (PHYS 212 recommended)

- **Arts**†

6 credits of any courses with a GA suffix

- **Humanities**†

6 credits of any courses with a GH suffix

- **Social & Behavioral Sciences**†

6 credits of any courses with a GS suffix

- **Health & Physical Activities**

3 credits of any courses with a GHA suffix

\* Computer Science students must receive a grade of C or better in this course.

† Students may apply 9-6-3 rule.

## **Core Requirements (65 credits)**

### **• Required Computer Science Courses (36 credits) †**

CMPSC 221	Object Oriented Programming with Web Applications
CMPSC 312	Computer Organization and Architecture
CMPSC 360*	Discrete Mathematics for Computer Science
CMPSC 430	Database Design
CMPSC 460	Principles of Programming Languages
CMPSC 462	Data Structures
CMPSC 463	Design and Analysis of Algorithms
CMPSC 469	Formal Languages with Applications
CMPSC 470	Compiler Construction
CMPSC 472	Operating System Concepts
CMPSC 487W	Software Engineering and Design
CMPSC 488	Computer Science Project

### **• Required Mathematics Courses (3 credits)**

Select one course from the following:

STAT 301	Statistical Analysis I
STAT 318	Elementary Probability
MATH 318	Elementary Probability

\* Computer Science students must receive a grade of C or better in this course.

† Students must earn a 2.5 or higher grade point average in the Required Computer Science Courses.

### **• Technical Electives (15 credits)**

Select at least 15 credits from the following. Other courses are to be chosen in consultation with the advisor and with program approval. **At least 9 of these technical elective credits must be from courses with a CMPSC prefix.**

CMPSC 313	Assembly Language Programming
CMPSC 412	Data Structures Lab (1.5 credits)
CMPSC 413	Algorithms Lab (1.5 credits)
CMPSC 426	Object-Oriented Design
CMPSC 428	Programming in Ada
CMPSC 438	Computer Network Architecture and Programming
CMPSC 441	Artificial Intelligence
CMPSC 444	Secure Programming
CMPSC 457	Computer Graphics Algorithms
CMPSC 475	Mobile Applications Programming

CMPS 496	Independent Studies
CMPS 497	Special Topics
MATH 401	Introduction to Analysis I
MATH 411	Ordinary Differential Equations
MATH 412	Fourier Series and Partial Differential Equations
MATH 425	Introduction to Operations Research
MATH 430	Linear Algebra and Discrete Models I
MATH 431	Linear Algebra and Discrete Models II
MATH 435	Basic Abstract Algebra
MATH 449	Applied Ordinary Differential Equations
MATH 450	Mathematical Modeling
MATH 455	Introduction to Numerical Analysis I
MATH 465	Number Theory
MATH 468	Mathematical Coding Theory
MATH 496	Independent Studies
MATH 497	Special Topics

• **Additional Electives** (11 credits)

6 credits from courses at 300-400 level and 5 credits from courses at 100-400 level are to be chosen in consultation with the advisor and with program approval.

**Additional Requirements**

- First-Year Seminar, 1 credit of any course with an **S**, **T**, **X**, or **PSU** designation. This requirement will typically be satisfied by ENGL 015S or ENGL 030S.
- United States Cultures and International Cultures Requirements: 3 credits of any course with a **US** designation **and** 3 credits of any course with an **IL** designation. These can be satisfied simultaneously with any of the above requirements, or any course in the degree requirements.
- Writing Across the Curriculum requirement is satisfied by CMPS 487W, a required course in the COMP degree program.

## APPENDIX B: BACHELOR OF SCIENCE TYPICAL SCHEDULE

The following table shows a typical class schedule for each semester in a 4-year curriculum.

Notes:

1. **Bold typed courses** require a grade of C or better.
2. The sum of the credits for courses marked with an asterisk (\*) must be 10.
3. Students must earn a 2.5 or higher grade point average in the following courses: CMPSC 221, 312, 360, 430, 460, 462, 463, 469, 470, 472, 487W, and 488.

Fall (First Year)		Spring (First Year)	
ENGL 015 or 030 — Composition	3	CAS 100 — Effective Speech	3
<b>MATH 140 — Calculus I</b>	<b>4</b>	<b>MATH 141 — Calculus II</b>	<b>4</b>
Humanities GH	3	Arts GA	3
Social and Behavioral Science GS	3	<b>CMPSC 121 — Intro. to Prog. Techniques</b>	<b>3</b>
Health and Physical Activity GHA	1.5	PHYS 211 – General Physics: Mechanics	4
	<b>14.5</b>		<b>17</b>
Fall (Second Year)		Spring (Second Year)	
Arts GA	3	Sciences GN	2-3*
Humanities GH	3	Social and Behavioral Science GS	3
Sciences GN (PHYS 212 recommended)	3-4*	CMPSC 221 – Object Oriented Programming with Web-Based Applications	3
Health and Physical Activity GHA	1.5	MATH 220 — Matrices	2
<b>CMPSC 122 — Intermediate Programming</b>	<b>3</b>	CMPSC 312 — Computer Organization and Architecture	3
<b>CMPSC 360 — Discrete Mathematics</b>	<b>3</b>	Health and Physical Activity GHA	1.5
	<b>16.5-17.5</b>		<b>14.5-15.5</b>

<b>Fall (Third Year)</b>		<b>Spring (Third Year)</b>	
CMPSC 462 —Data Structures	3	CMPSC 430 — Database Design	3
STAT 301 — Statistical Analysis, MATH 318 – Elementary Probability, or STAT 318 – Elementary Probability	3	CMPSC 463 — Design and Analysis of Algorithms	3
ENGL 202C – Technical Writing GWS	3	CMPSC 469 — Formal Languages with Applications	3
Select 3-5 credits of 100-400 level courses in consultation with an academic advisor	3-5*	Select 3 credits from: CMPSC 313, 412, 413, 428, 438, 441, 444, 455, 457, 475, 496, 497, MATH 401, 411, 412, 425, 430, 431, 435, 445, 449, 450, 455, 465, 496, 497	3
Select 3 credits of 100-400 level courses in consultation with an academic advisor	3	Select 3 credits of 300-400 level courses in consultation with an academic advisor	3
	<b>15- 17</b>		<b>15</b>
<b>Fall (Fourth Year)</b>		<b>Spring (Fourth Year)</b>	
CMPSC 470 — Compiler Construction	3	CMPSC 460 — Principles of Programming Languages	3
CMPSC 472 — Operating System Concepts	3	CMPSC 488 — Computer Science Project	3
CMPSC 487W — Software Engineering and Design	3	Select 6 credits from: CMPSC 313, 402, 426, 428, 438, 441, 457, 496, 497, MATH 411, 412, 425, 430, 431, 435, 445, 450, 475W, 496, 497	6
Select 6 credits from: CMPSC 313, 412, 413, 428, 438, 441, 444, 455, 457, 475, 496, 497, MATH 401, 411, 412, 425, 430, 431, 435, 445, 449, 450, 455, 465, 496, 497	6		<b>12</b>
	<b>15</b>		

## **APPENDIX C: MASTER OF SCIENCE DEGREE REQUIREMENTS**

A total of 30 graduate credits, of which 18 must be at the 500 level or above, is required for the degree Master of Science in Computer Science. A minimum grade point average of 3.0 must be earned for course work that is applied toward the graduate degree. As noted earlier, twelve credits in the Integrated Program can apply to both the Bachelor of Science degree and the Master of Science degree. Refer to the *Reduced Course Load* portion of Section II for more details.

### **Required Courses (12 credits)**

- COMP 505      Theory of Computation
- COMP 511      Design and Analysis of Algorithms
- COMP 512      Advanced Operating Systems
- COMP 519      Advanced Topics in Database Management Systems

Additionally, students are required to complete either a thesis or a paper according to one of the two options described below.

Students who believe that they have completed a course substantially similar to one of the specific course requirements may apply to have their previous work evaluated for the purpose of exemption to that requirement. If the exemption is granted, another approved course shall be taken in place of that required course. The remaining 18 credits must be completed according to one of the following options:

### **Thesis Option (18 credits)**

Research into a specific computer science problem, development of a scholarly written paper, and an oral defense. This option requires:

- 6 credits of COMP 600
- 3 additional credits from approved 500 level electives in computer science, mathematics, engineering, and information systems courses
- 9 credits from approved 400 and 500 level electives in computer science, mathematics, engineering, and information systems courses. A list of 400 level courses that can be used for graduate credit can be found below.

### **Paper Option (18 credits)**

- 3 credits of COMP 594 Master's Studies. An in-depth study of a specific computer science problem, development of a written paper or project, and an oral defense.
- 9 credits from approved 500-level electives in computer science, mathematics, engineering, and information systems courses

- 6 credits from approved 400 or 500 level electives. A list of 400 level courses that can be used to satisfy the degree requirements are listed below. 500-level electives in computer science, mathematics, engineering, and information systems courses are to be chosen in consultation with the student's advisor and with program approval.

### **400-level Courses that Can Be Used to Satisfy Degree Requirements**

- **Computer Science Courses**
  - CMPSC 425: Advanced Object-Oriented Programming
  - CMPSC 426: Object-Oriented Design
  - CMPSC 428: Programming in Ada
  - CMPSC 436: Communications and Networking
  - CMPSC 438: Computer Network Architecture and Programming
  - CMPSC 441: Artificial Intelligence
  - CMPSC 452: Numerical Analysis I
  - CMPSC 457: Computer Graphics Algorithms
  - CMPSC 460: Principles of Programming Languages
  - CMPSC 469: Formal Languages with Applications
  - CMPSC 470: Compiler Construction
  - CMPSC 487W: Software Engineering and Design
  - CMPSC 497: Special Topics (This course may or may not count toward graduate credit; it depends on the specific topic)
- **Mathematical Science Courses**
  - MATH 412: Fourier Series and Partial Differential Equations
  - MATH 425: Introduction to Operations Research
  - MATH 431: Linear Algebra and Discrete Models II
  - MATH 450: Mathematical Modeling