INFS 501 Syllabus & Assignments: Fall 2017

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Office Hours:	By appointment (usually Monday 5-6 PM)	5321 Engineering Bldg.

Web Site: Syllabus updates, sample problems & solutions, lecture notes etc. are posted weekly after class at http://mymason.gmu.edu.

Schedule: 14 Classes 7:20-10:00 PM   Art and Design Bldg, Room 2026
- On Mondays except the 6th class is on Tuesday Oct 10, 2017
- The Final Exam is Monday December 18, 2017, 7:30-10:15 PM

Prerequisite: "Completion of 6 hours of undergraduate mathematics." As a practical matter, you need a working knowledge of algebra, including the laws of exponents. Several free tutorials may be found on the Internet. Also see textbook Appendix pages A1-A3.

Topics: We will follow the textbook in this order: Chapters 5, 4, 2, 3, 6, 7, 8, 10, and 9. We will focus on problem solving, using fundamental definitions, theorems, and algorithms.

Calculator: You will need a calculator that can display 10 digits and raise numbers to powers. During an exam or quiz: Do <u>not</u> share a calculator or use a computer; cell phones must be put away.

Textbook: Discrete Mathematics with Applications, 4th ed. (8/4/2010) By Susanna S. Epp, ISBN-10: 0495391328; ISBN-13: 978-0495391326. A copy will be on 2-hour reserve at the Johnson Center Library. Ebooks <u>cannot</u> be used during an exam.

Exams: We will have: (i) 2 Quizzes, (ii) 2 Hour Exams, and (iii) a comprehensive Final Exam (Monday December 18, 2017). The Quizzes and Hour Exams will be "open book & notes." However, the Final Exam will be "closed book & notes." Exams and Quizzes will be given only one time - no makeup exams. I often give partial credit when grading. However, <u>no</u> partial credit will be given for a purported proof to a false statement. During an exam or quiz: Use all available classroom space, and avoid sitting next to a friend or close to anyone else.

Grades:
1 Final Exam: 45% of final grade.
2 Hour Exams: 40% of the final grade (20% each)
Homework and Quizzes together: remaining 15% of final grade.

Help: Questions? Send me an e-mail! Use the ^ symbol for exponents, * for multiplication. You may also e-mail a pdf or scanned image.

Homework: Homework assignments will be on the weekly Syllabus updates. See http://mymason.gmu.edu. Homework will never be accepted late. However, of the 13 Homework assignments, only the 12 with the highest percentage scores will be counted toward your grade. Submit on paper, or scan as a black/white pdf & e-mail if you cannot attend class. (Grey-scale pdfs are poor and waste toner!)

Honor Code: Honor Code violations are reported to the Honor Committee. See http://cs.gmu.edu/wiki/pmwiki.php/HonorCode/CSHonorCodePolicies
Special for INFS501: No Honor Code violation if you collaborate on H/W or if you submit solutions from class discussion.

E-mail: To comply with privacy rules, you must use your Mason email for all e-mails with me. You may forward your Mason email elsewhere, but I may respond only to a Mason email account.

Semester Schedule: Hour-Exam and Quiz Dates Are Subject-to-Change

Class	Date	Event	Details
(1)	Aug 28, 2017	1st Class	
	Sep 4, 2017		Labor Day Holiday
(2)	Sep 11, 2017		
(3)	Sep 18, 2017	Quiz 1	Problems will be like in the Sample Quiz and the Homework.
(4)	Sep 25, 2017		
(5)	Oct 2, 2017		
(6)	Oct 10, 2017		6th class is Tuesday after Columbus Day
(7)	Oct 16, 2017	Hour Exam 1 & Lecture	
(8)	Oct 23, 2017		
(9)	Oct 30, 2017		
(10)	Nov 6, 2017	Quiz 2	
(11)	Nov 13, 2017		
(12)	Nov 20, 2017		
(13)	Nov 27, 2017		
(14)	Dec 4, 2017	Hour Exam 2 & Lecture	
(15)	Dec 18, 2017	FINAL EXAM	The Final Exam will cover everything from the entire semester. Problems will be like in: (1) the Sample Quizzes & Sample Exams, (2) the prior Quizzes & the prior Exams, (3) the Homework.

Assignments are updated within approximately 24 hours after each class.

Row	§	Problems are from the textbook or written out below.	Due
(1)	5.1	7, 13, 16, 32, 57, 61, 83 On 5.1.57, just calculate the sum for n=5. No need to change variable like problem 5.1.57 asks.	HW-1 9/11/2017
(2)	5.2	23, 27, 29. <u>Hint</u>: Try using Example 5.2.2 on page 251 & Example 5.2.4 on page 255.	HW-1 9/11/2017
(3)	5.1	True or False? Why? $\sum_{k=1}^{n}(8k^3+3k^2+k)=n(n+1)^2(2n+1)\forall n\in Z^+$	HW-1 9/11/2017
(4)	5.6	2, 8, 14, 33, 38. <u>Hints</u>: On 5.6.14, you may mimic Part (1) of the "Second Order Recurrence Example" on BlackBoard. (You'll need different values for the constants raised to powers & for the recursion coefficients A & B). On 5.6.33, you may choose to use the Hint on Blackboard.	
(5)	5.7	1c, 2(b)&(d), 4, 23, 25	
(6)	5.8	12, 14 This problem is a little different than #12. Use Theorem 5.8.5 instead of Theorem 5.8.3. E-mail me if you have trouble solving the Characteristic Equation on either #12 or #14.	
(7)	4.1	3, 5, 8, 12, 27, 36, 50. #50 requires directly applying the definitions of "even" and "odd" (on pg. 147) instead of using well-known properties of even & odd numbers. Those properties are derived the hard way, from the definitions, like we are doing in § 4.1.	
(8)	4.2	2, 7, 20, 28	
(9)	4.3	3, 5, 21, 41	
(10)	4.4	6, 21, 25, 35, 42, 44 [#35 & #42 are like #4.4.43 on BlackBoard.]	
(11)	4.8	12, 16; 20(b) [Don't worry much about syntax. To describe an algorithm, we must describe: (i) its input, (ii) what it says to do, and (iii) its output.]	
(12)	4.8	Find GCD(98741, 247021).	
(13)	4.8	Observe: $247{,}710^2 - 38{,}573^2$ $= 61{,}360{,}244{,}100 - 1{,}487{,}876{,}329$ $= 59{,}872{,}367{,}771 = 260{,}867*229{,}513$. Now factor 260,867 in a non-trivial way.	

Row	§	Problems are from the textbook or written out below.	Due
(14)	4.8, 5.8	Write the Fibonacci no. F_{400} in scientific notation, e.g. $F_{30} \approx 1.35*10^6$. Note: Be careful if you try using formulas on the Internet. Epp defines the Fibonacci sequence starting at F_0=1 while some others (like Wikipedia) start the sequence at F_0=0, F_1=1. Both enumerations list the same set of numbers.	
(15)	2.1	15, 33, 43. For #43, see 2.1.41 on BlackBoard. For #33, see the Java problem in "Symbolic Logic Compared to Set Theory" on BlackBoard.	
(16)	2.2	4, 15, 27 [For 2.2.4, see the bottom table on page 1 of "Truth Tables, Arguments Forms & Syllogisms" on BlackBoard.] A truth-table example on BB is 2.2.8.	
(17)	2.3	10, 11	
(18)	4.4	Suppose we are given an integer x. Now call the statement *s* = "(x^2-x) is exactly divisible by 3." Choose <u>one</u> of the answers A, B, or C below. Then complete your answer with a proof if your answer is A or B; or with an explanation if your answer is C.: **(A)** Prove s is true; **(B)** Prove s is not true; <u>or</u> **(C)** Explain why (A) and (B) are impossible.	
(19)	3.1	12, 17(b), 18(c)-(d), 28(a)&(c), 32(b)&(d)	
(20)	3.2	10, 17, 25(b)-(c), 38. (In #38, "Discrete Mathematics" refers to the phrase "Discrete Mathematics," not the Discrete Math subject.)	
(21)	1.2	4; 7(b),(e)&(f); 12 (Section 1.2 fits with Ch. 6 on Set Theory.)	
(22)	6.1	7b; 12(a),(b),(g)&(j); 13; 18	
(23)	6.1	Of a population of students taking 1-3 classes each, exactly: 19 are taking English, 20 are taking Comp Sci, 17 are taking Math, 2 are taking only Math, 8 are taking only English, 5 are taking all 3 subjects, and 7 are taking only Computer Science. How many are taking exactly 2 subjects?	
(24)	6.2	10, 14, 32	
(25)	6.3	2, 4, 7, 20, 21. [Is-an-element-of proofs work for verifying a "for-all-sets" identity. We may instead verify or find a counterexample by calculating with numbered Venn-Diagram regions. However, NO solution based on Venn-Diagram shading will be accepted - shading alone is usually confusing & unconvincing.]	

Row	§	Problems are from the textbook or written out below.	Due
(26)	6.3	Prove or disprove: (i) ∃ sets A, B & C such that (A-B)-C = (A-C)-(B-C), (ii) ∀ sets A, B & C, (A-B)-C = (A-C)-(B-C).	
(27)	1.3	15(c),(d),&(e); 17. These little problems fit with Ch. 7 on Functions.	
(28)	7.1	2; 5; 14; 51(d),(e),&(f)	
(29)	7.2	8, 13(b), 17 - We'll go over these problems in class	
(30)	7.3	2, 4, 11, 17	
(31)	8.3	10 [Compare with solution to 8.3.12 on BlackBoard.]	
(32)	8.4	2, 4, 8, 17, 18	
(33)	8.4	Calculate 2^{373} (mod 367). [Hint: If it matters, 2, 367, and 373 are all prime numbers.]	
(34)	8.4	12b, 13b [Hint: If we call the hundred's digit "h," the tens digit "t," and the unit's digit "u," then the 3-digit base-10 number htu = h*10^2+t*10+u. For 12b, reduce the 10's (mod 9). For 13b, reduce the 10's (mod 11). The same approach works no matter how many digits a positive integer has.]	
(35)	8.4	Solve for x: 1014*x ≡ 7 (mod 4,157), 0 ≤ x ≤ 4,156.	
(36)	8.4	#20, 21, 23, 27, 32, 37, 38, 40 [#21-27] Hints: The given encryption-decryption pair (mod 55) is (3,27). (3,27) works because 55 = 5*11, (5-1)(11-1)=40, so Little Fermat Theorem implies x^{40} ≡ 1 (mod 55) if gcd(x,55)=1, and 3*27 ≡ 1 (mod 40). [#40] Hint: The decryption exponent is from #38 since modulus 713 = 23*31, (23-1)(31-1)=660, so the LFT implies x^{660} ≡ 1 (mod 713) when gcd(x, 713)=1.	
(37)	8.4	Solve for x: x^2 ≡ 4 (mod 675,683). Give all 4 solutions. All 4 answers should be between 0 & 675,682. Use 675,683 = 821 * 823, the product of 2 prime numbers. [See "Square roots (mod pq) two examples.pdf," on BlackBoard. This problem shows why RSA is susceptible to attack following the approach in Row (13) above.	
(38)	8.4	Under RSA: p = 13, q = 17, n = 221, & e = 37 is the encryption exponent. Find the decryption exponent d.	
(39)	10.1	4, 19, 20, 29, 34	
(40)	10.2	8(b),(c)&(d); 9; 10 - We will go over each of these problems in class on 11/16/2017.	

Row	§	Problems are from the textbook or written out below.	Due
(41)	10.4	#4, #11 & #13. On 4, 11, & 13, explain why the given pair of graphs cannot be isomorphic. Hint on 13: Look for circuits of length 5. #15. Hint on #15: There are 11 non-isomorphic simple graphs with 4 vertices. Note: Intuitively, two graphs are isomorphic if with suitable re-labeling, one graph can be deformed into the other by stretching & bending etc., without tearing, breaking, or adding or subtracting components. The technical definition of isomorphism is often impractical to use with graphs. See the last paragraph on page 678 of the textbook.	
(42)	10.5	15, 16, 17, 18, 19	
(43)	10.6	15, 16, 17, 18	
(44)	9.1	7, 10, 12(b)(ii)-(iii), 14(b)-(c), 20	
(45)	9.2	8, 12(b), 17(a),(b)&(d), 22, 33, 40 We will go over the § 9.2 problems in class	
(46)	9.5	7(a)-(b).	