April 20, 2000

Math review for the final exam

Exam conditions The final exam will be "open book, open notes". You may bring to the exam anything additional to help you which is *non-living.**

Rules

- In each case, you should show your work, explain your answer, etc.: an answer alone generally will *not* be sufficient for full credit!
- Write answers to "mod" questions in standard form: although $20 = 2 = -16 \bmod 18$ etc., the standard form would be **2**: always an integer between 0 and the modulus.

Problem 1 Which of $\left(10^{44}\right)^{55}$ and $\left(10^{44}\right) \cdot \left(10^{55}\right)$ is larger?

Problem 2 What is 56 mod 6?

Problem 3 What is 3798107541 mod 9?

Problem 4 What is 3798107541 mod 11?

Problem 5 What is $7^{322222224512}$ mod 8? ($7 = 8 - 1$.)

Problem 6 What is $7^{322222224512}$ mod 7?

Problem 7 What is $7^{322222224512}$ mod 6? ($7 = 6 + 1$).

Problem 8 What is $3 \cdot (6^{200}) + 2 \cdot (8^{333}) + 4$ mod 7? ($6 = \ldots$ and $8 = \ldots$.)

Problem 9 What is $42^{1234567}$ mod 4?

Problem 10 What is the table of addition mod 5?

Problem 11 What is the table of multiplication mod 5?

Problem 12 Solve $2x + 1 = 4$ mod 5.

Problem 13 Solve $2x + 1 = 4$ mod 6.

Problem 14 Solve $3x + 1 = 4$ mod 6.

Problem 15 Define **prime number**. Explain briefly why arithmetic mod a prime number is more like standard arithmetic than arithmetic mod a non-prime number.

Problem 16 What is 23 in binary?

Problem 17 What is 10110001 in decimal?

Problem 18 How many different bitstrings 7 bits long are there?

Problem 19 What is the xor of the bitstrings 11001 11100 and 10101 00111?

Problem 20 Which is more work ("work"=one-digit arithmetic operations): squaring one hundred numbers 50 decimal digits long or adding ten pairs of numbers 5,000 decimal digits long?

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* The instructor will judge if something is "alive". I included this stipulation because of the following story: At Caltech one semester, a physics instructor said that on the final exam, students could use "anything they could carry in." One student carried in Richard Feynman. You should know who Richard Feynman is (ground-breaking theoretical physicist) and something of his character (first-class crazy person) to appreciate this.