

**Teaching Assistant: Hussein Awala ( Fal-2012, Fall-2013 )**

**The Course :** Mathematics 0824.

**Course Title:** Math Patterns 824.

**Instructor:** Paulos, John A.

**Instructor Office:** Wachman 542.

**Instructor Email:** paulos@temple.edu

**Office Hours:** by appointment.

**Prerequisites:** some ability to think critically.

**Textbook:** none, course notes.

**Course Goals:** to develop an understanding of the uses and abuses of mathematics in everyday life.

**Topics Covered:** Mathematical Patterns by John Allen Paulos paulos@temple.edu  
There will be three basic units in the course: Basic Numeracy, Probability, and Logic and Puzzles. The approach will be primarily via suggestive stories that illuminate the ideas in question rather than through general principles or excessive computation. This means that the course will focus on mathematical ideas, not computation and formulas, and on the vignettes and applications to everyday life and social issues that illustrate them. I. Basic Numeracy We'll start out discussing certain essential numbers: coast to coast distance, population of the US, the population of the the world, approximate number of deaths annually from various common diseases contrasted with the number of deaths in more dramatic contexts, the difference between a million, billion, and trillion, and so on. Incidentally, a million seconds takes approximately 11 1/2 days to tick by, a billion seconds is about 32 years, and a trillion seconds 32,000 years. We'll talk about estimating and comparing: How much human blood in the world? How many homeless in NYC, how many battered women, and so on. Related to this are so-called Fermi problems. Physicist Enrico Fermi was known for challenging his classes with problems that, at first glance, seemed impossible. One such was estimating the number of piano tuners in Chicago given only the population of the city. Dimensional analysis, basic conversions, scientific notation come next. For example, how fast does human hair grow in miles per hour? Cost of beef in drachma per kilogram, many disparate conversions. May seem irrelevant until one starts talking of the equivalents of the one trillion dollars spent in Iraq, for example (130 EPA's, 170 NSF's, 200 NCI's). Voting: Olympics (judges, precision), presidential elections, Lani Guinier, Oscars, Enron.

Puzzles and paradoxes. II. Probability and Statistics Psychological aspects of statistics: The very important anchoring effect, availability error, and confirmation bias. Examples from Tversky, Kahneman, and other cognitive psychologists. Relevance to the stock market. Sample spaces, examples (coins, dice, heights, incomes) Probability rules (sum rule, product rule, at least one rule). Expected value. Conditional probability. Racial profiling and false positives. Bayes' theorem. Cancer test (98% accurate, 1 out of 200 with cancer, 10,000 tests administered.). Surveillance programs. OJ Simpson verdict. Lie detector tests. Expected value, insurance, blood tests, Pascal's wager, etc. correlation versus causation. Coincidences and birthday problem. Probability of a particular event vs probability of some event of a general sort. JFMAMJJASOND, MVEMJSUNP. Significant? No. And, of course, the birthday problem and the optimal strategy for picking the best spouse when meeting candidates sequentially. Various classic puzzles and stories: the Monty Hall problem, gambler's ruin, the gambler's fallacy and gambler's ruin, the Banach match box problem, the drunkard's random walks, the St. Petersburg paradox, the random chord problem, the hot hand, monkeys randomly typing on a typewriter, the Buffon needle problem, and many others. Lotteries, a tax on innumeracy. Rare events. Finally, among the news stories covered will be many of the following: air safety, relative risks; scoring streaks, "hot hands," and records in sports; health hazards of all sorts; statistics, expert witnesses, and the courts!; the U.S. Census; redistricting, elections, especially 2000 and 2004 presidential election; use of DNA and, more generally, (conditional) probability in the courts; randomized clinical trials; "studies show," "many," and "may be linked"; epidemiology, AIDS; the stock market and the random walk hypothesis; economic statistics and reporting; environmental concerns, contamination reports; conspiracies, hoaxes, especially on the internet; demographic variations, social work issues; reliability of political polls; lotteries and other gambling issues; junk science of all sorts. III. Elections, Geometric Scaling, Puzzles and Paradoxes, News Stories We'll also discuss various voting systems, a mathematical definition of power, a bit of geometry and scaling quantities upward and downward, as well as a number puzzles, paradoxes, psychological oddities, and a wide variety of news stories and contemporary issues.

**Course Grading:** 3 quizzes, section work, final.

**Exam Dates:** to be announced.

**Attendance Policy:** strongly encouraged.

Any student who has a need for accommodation based on the impact of a disability should contact me privately to discuss the specific situation as soon as possible.

Contact Disability Resources and Services at (215) 204-1280, 100 Ritter Annex, to coordinate reasonable accommodations for students with documented disabilities.

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