**Mth 21, Homework 4 on sections 7.5, 3.1**

Due by Wed, Oct 22.

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Write all your working out and answers neatly by hand on your own notepaper and hand them to me by the date shown. Please use lots of space. You do not need to write the questions, but it is very important that you show clearly any work you had to do to get your answers. Each question is worth 3 points.

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**Section 7.5 Fibonacci numbers and the Golden Ratio**

**(1)** The Fibonacci numbers are a sequence of numbers that start

$$F_1 = 1, \quad F_2 = 1, \quad F_3 = 2, \quad F_4 = 3, \ldots$$

with the next number the sum of the previous two. Compute this sequence up to $F_{15}$. (Hint: you should get $F_{15} = 610$.)

**(2)** Honey bees have unusual family trees. Males (drones) have a single parent, the female queen. Female bees (workers or queens) have two parents, one male and one female. How many great-great grandparents does a single drone have? Your answer will be a Fibonacci number.

**(3)** Use Binet's formula

$$F_n = \frac{\phi^n - 1/(-\phi)^n}{\sqrt{5}}$$

to compute the sixteenth Fibonacci number as follows:

- **(a)** On your calculator compute the golden ratio $\phi = (1 + \sqrt{5})/2$
- **(b)** Raise this number to the power $16$
- **(c)** Divide your answer by $\sqrt{5}$ and round to the closest integer. That is $F_{16}$. (The $-1/(-\phi)^n$ part of Binet's formula may be ignored as it is very small.)

**(4)** Check that your answer in Question 3 is the sum of $F_{14}$ and $F_{15}$ in Question 1.

**(5)** Draw an accurate picture of the "Golden rectangle" with its inside square. Your rectangle's length should be $\phi = (1 + \sqrt{5})/2 \approx 1.618$ times its height.

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**Section 3.1 History of probability**

**(6)** The study of probability began with gambling games. Roll a die. (A die is a six sided cube with $1$ to $6$ dots on each side. The plural of die is dice.) What is the probability of the number $3$ coming up? Give your answer as a fraction, a decimal and a percent.

**(7)** Suppose the probability of rain tomorrow is $0.8$. Convert this to a percent and a fraction. Is it likely or unlikely to rain tomorrow?

**(8)** If you roll a $10$-sided die, with numbers $1$ to $10$, what is the probability of

**(a)** the number $7$ coming up?

**(b)** the number $20$ coming up?

**(c)** any number from $1$ to $10$ coming up?

**(9)** In a roulette game you bet \$20 on the number $7$. The house odds are 35 to 1 for this bet. If the ball doesn't finish on 7 then you lose your \$20. What happens if the ball does finish on 7?

**(10)** If you roll a die $18$ times, how many times do you expect the number $4$ to come up? Try this experiment and record how many $4$s you get.

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If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes and section in the textbook.
- Check if you get the right answer for a similar odd-numbered question in the textbook (answers at the back of the book).
- Ask me about it after class.
- Come to my office hours: Mon 11:30 - 12:30, Wed 11:30 - 12:30 in CP 317.
- Go to the Math Tutorial Lab in-person in CP 303 or online.