Choose 4 problems from PART A and 2 problems for PART B. Any additional correctly solved problem will give you extra points!

PART A

1. **The Gym Lock.** A lock has a disk with 36 numbers written around its edge. The combination to the lock is made up of three numbers (such as 12-33-07). How many different possible combinations are there for this lock?

2. **Dicy Die.** You roll a six-sided die four times in a row:
   
   (a) How many possible outcomes of rolling a die four times are there?
   
   (b) How many of these outcomes do not contain a 6?
   
   (c) Given the answer to the previous question, how many of these outcomes contain a 6?

3. **DNA dreams.** We are examining 20 genes from a DNA sample, and each of these genes can occur as two different alleles. How many possible patterns are there for these 20 genes?

4. **Moving Up.** You have a part-time job in a department with 19 other people. Word comes out that 3 of the people from that department will be promoted to Supervisor, Assistant to the Director, and Sales Rep. How many ways are there to assign 3 people out of your group of 20 to these 3 positions?

5. **Bowl and Box.** A bowl contains three marbles (silver, gold and pink). A box contains five tickets, numbered 1 through 5. One marble is selected at random, and then a ticket is selected at random. Find the number of possible outcomes.

6. **Number please.** Someone you really wanted to go out on a date with gave you a beeper number. You did not write it down and remember only the area code and the exchange (the first three digits of the number). How many different numbers are there with that area code and exchange?

7. **Dressing for success.** You have 5 T-shirts, 10 shorts, and 3 pairs of underwear, and you wear one of each. How many different ensembles can you put together?

PART B

8. **Monday’s undies.** You are spending the weekend at a friend’s parents’ house. You need 3 pairs of underwear and have 10 clean pairs of underwear of different colors. How many different underwear triples can you pull out to impress your friend’s folks?

9. **The Great Books.** There are 20 Great Books, from which you know your English prof will select 10. You are an overachiever and want to figure out how many different combinations of 10 books the prof can pick. How many?

10. **Morning variety.** You wish to have a different breakfast every morning. Each day you choose exactly four of the following items: eggs, bagel, pancakes, coffee, orange juice, cereals. How many days can you go before you must eat a breakfast combination that you have already had?

11. **Coin Count.** On your bureau, you have a half dollar, quarter, dime, nickel, and penny.
(a) How many different totals can be formed using exactly 3 coins?
(b) How about using four coins?
(c) How about using all five coins?

Solutions. 1: $36^3$, 2a: $6^4$, 2b: $5^4$, 2c: $6^4 - 5^4$, 3: $2^{20}$, 4: $20 \times 19 \times 18$, 5: $3 \times 5$, 6: $10^4$, 7: $5 \times 10 \times 3,$

8: $\frac{10 \times 9 \times 8}{3!}$, 9: $\frac{20 \times 19 \times 18 \times 17 \times 16 \times 15 \times 14 \times 13 \times 12 \times 11}{10!}$, 10: $\frac{6 \times 5 \times 4 \times 3}{4!}$, 11a: $\frac{5 \times 4 \times 3}{3!}$, 11b: $\frac{5 \times 4 \times 3 \times 2}{4!}$

11c: 1.