1. A 65 year old woman takes out a $100,000 life insurance policy. The company charges an annual premium of $520. Estimate the company’s expected profits on such policies if mortality tables indicate that only 2.6% of women age 65 die within a year. (5)

\[
\begin{array}{c|c}
\text{Profit} & \text{Policy} \\
520 & 0.974 \\
-994.80 & 0.026 \\
\end{array}
\]

\[\mu = -2080\]

2. In some cities, tall people who want to meet and socialize with other tall people can join Beanstalk Clubs. To qualify, a man must be over 6’2” tall, and a woman over 5’10”. According to the National Health Survey, heights of adults may have a Normal model with mean heights of 69.1” for men and 64.0” for women. The respective standard deviations are 2.8” and 2.5”. (Be sure to convert if needed!) Beanstalk members believe that height is an important factor when people select their spouses. To investigate, we select a random married man and, independently, a random married woman.

a. Define two random variables and use them to express how many inches taller the man is than the woman. (3)

\[M = \text{man’s height} \]
\[W = \text{woman’s height} \]
\[M - W = \# \text{ inches taller a man is} \]

b. What is the mean of this difference? (2)

\[\mu_m - \mu_w = \mu_d \]
\[69.1 - 64 = 5.1 \]
\[\mu_d = 5.1 \]

c. What’s the standard deviation of this difference? (2)

\[\sigma_d = \sqrt{2.8^2 + 2.5^2} \]
\[\sigma_d = 3.7535 \]

d. What’s the probability that the man is taller than the woman? (3)

\[P(0 < Z < 4) = 0.9128 \]
3. A college student on a seven-day meal plan reports that the amount of money he spends on daily food varies with a mean of $13.50 and a standard deviation of $7.

a. What is the mean and standard deviation of the amount he might spend in two consecutive days? (4)
   \[ \mu_2 = 2(13.50) = 27 \]
   \[ \sigma_2 = \sqrt{(17)^2} \cdot 2 = 9.90 \]

b. Estimate his average weekly food costs, and the standard deviation. (4)
   \[ \mu_7 = 7(13.50) = 94.50 \]
   \[ \sigma_7 = \sqrt{(17)^2 \cdot 7} = 18.52 \]

c. Do you think he’ll spend more than $50 in a week? Explain (4)

![Normal distribution graph]

4. Each year a company must send three officials to a meeting in China and five officials to a meeting in France. Airline ticket prices vary from time to time, but the company purchases all tickets for a country at the same price. Past experience has shown that tickets to China have a mean price of $1000, with a standard deviation of $150, while the mean airfare to France is $500, with a standard deviation of $100.

a. Find the mean and standard deviation of the total cost to send these officials to their meetings. (4)
   \[ \mu_T = 3(1000) + 5(500) \]
   \[ \mu_T = 5500 \]
   \[ \sigma_T = \sqrt{150^2 \cdot 3 + 100^2 \cdot 5} \]
   \[ \sigma_T = 348.78 \]

b. Find the mean and standard deviation for the difference in the price of a ticket to China and a ticket to France. (4)
   \[ \mu_{c-f} = 1000 - 500 = 500 \]
   \[ \sigma_{c-f} = \sqrt{150^2 + 100^2} \]
   \[ \sigma_{c-f} = 180.28 \]

c. Assuming the price of airline tickets follows a normal distribution, what is the probability that the total cost of sending all 8 people is more than $4000. (3)

![Normal distribution graph]
5. To play a game, you must pay $5 for each play. There is a 10% chance that you'll win $5, a 40% chance that you'll win $7, and a 50% chance that you'll only win $3.

   a. What are the mean and standard deviation of your net winnings? (4)

   b. You play twice. Assuming the plays are independent of one another, what are the mean and standard deviation of your total winnings? (4)

\[
\begin{array}{c|c|c}
\text{winnings} & \text{prob} \\
0 & 0.1 \\
2 & 0.4 \\
-2 & 0.5 \\
\end{array}
\]

\[
\begin{array}{c|c|c}
\text{winnings} & \text{prob} \\
5 & 0.1 \\
7 & 0.4 \\
3 & 0.5 \\
\end{array}
\]

\[
\mu = 0.9 \\
\sigma = 0.9
\]

\[
\mu_T = 2(0.9) = 1.80 \\
\sigma_T = \sqrt{(0.9)^2} = 0.9
\]

Bonus (up to 5 points)

You're planning a trip to Kyrgyzstan and buy a copy of *Kyrgyzstan on 4237 ± 360 Soms a Day*. The book claims that you can travel in Kyrgyzstan for an average of about 4237 soms each day with a standard deviation of 360 soms. Using that information, make the following estimates about your trip.

   a. Your budget allows for you to spend 90,000 soms. To the nearest day, how long can you afford to stay in Kyrgyzstan, on average?

\[
\frac{90,000}{4237} = 21 \text{ days}
\]

   b. What's the standard deviation of expenses for a trip of that duration?

\[
6_{21} = \sqrt{(360)^2 \cdot 21} = 1649.73
\]

   c. You doubt that your total expenses will exceed your expectations by more than 2 standard deviations. How much extra money should you bring? On average, how much of a “cushion” will you have per day?

\[
21(4237) + 2(1649.73) = 92976.76
\]

\[
92,976.76 \text{ soms}
\]

\[
= 4394.1 \text{ soms per day}
\]

\[
- 4237
\]

\[
157.1 \text{ extra per day}
\]