Name _________________________________
Lecture Section  A_____________________
Project Section (or name of your Project Professor): ________________

Amount at compound interest: \( F_n = P (1+i)^n \)

Installment loan payments: \( A = P \frac{i(1+i)^n}{(1+i)^n - 1} \)

Future worth of a sinking fund: \( F_n = A \frac{(1+i)^n - 1}{i} \)
1. (25 pts out of 100pts) You own a hamburger franchise selling the famous Hawk Burger. The parent company, Hawk Burger Inc. has purchased a high speed computer system at an expected cost of ten million dollars. The system will keep track of business for all 1200 of its franchises in the United States.

Draw cash flow diagram for each part below.

a) What are the annual payments on the company’s 5-year loan to buy this system? Assume the banks gives the company an annual percentage rate of 6% and requires no down payment. Draw the diagram.

b) The parent company requires each franchise owner to pay an annual fee for 5 years to recover the ten million dollar cost. What are these equal annual fees for each franchise? Assume that the system has no salvage value. Draw the diagram.

c) The cost of a replacement computer system decreases by 15% each year due to advances in technology. At the end of five years, the computer system is replaced with a new one which also has a 5 year life. How much does the replacement system cost? Assume no salvage value. Draw the diagram.
2. (25 pts out of 100pts) A truck carrying a toxic substance explodes and crashes into a Lake. As a result the lake becomes contaminated with the toxic substance. Fortunately, it reacts with water and disappears with time. The concentration of the toxic substance, C, follows an exponential law with respect to time, t,

\[ C = b e^{kt} \]

where \( b \) and \( k \) are constants.

Your assistant has obtained concentration (in mg/L units) vs. time data, appropriately transformed the data, and prepared a plot on rectilinear paper as shown below.

![Graph showing natural log of concentration vs. time](image)

a) What are the values of \( b \) and \( k \) ?

b) How many hours after the satellite crashes will it take for the concentration of the toxic to be reduced to 0.22 mg/L? (You may do this either by calculation or by correctly reading off the graph).
You own a large consulting firm that hires many engineers, technicians, administrators, and secretaries. You need an up-to-date computer system to support your firm's activities. This computer system includes hardware, annual maintenance, and a computer administrator. In addition, your computer administrator is so good that you also think that you can sell your services (server space, web support, backup services etc) once you have the right computer system. The following is your analyses of the costs associated with all this:

1) Purchase computer hardware for $50,000.
2) Pay an annual maintenance cost of $5,000.
3) Pay computer administrator $40,000 per year.
4) Sell computer services to others bringing your company an added income of $10,000 per year for each year.
5) Sell the system as salvage at the end of 5 years for $5,000.

Carefully show all work and give answers to the nearest cent. Assume a 6% per year interest rate compounded annually and a 5-year life of the computer system.

a) Draw the cash-flow diagram for the computer system you intend to purchase (include all costs). **Draw the diagram from your perspective.**

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b) What is the present worth of this five-year plan? Clearly label individual calculations, identifying their purpose (e.g., Equation 1 calculates the present worth of the capital investment). Use the next page if you need more space.
4. (25 pts out of 100pts) You are studying the relationship between subsurface temperature and the depth below the earth's surface. You have measured *temperature as a function of depth* (using probes inserted in a mine shaft) which you have been told follows a power law. Plot the data on the correct paper with the dependent variable as the y axis. Carefully label the x and y axes as to independent and dependent parameter names and numerical values of important lines.

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