Mini-Project 1

Xiaoning is about to graduate with a Masters Degree in Financial Engineering. He has been offered a three-year contract as a derivatives quant on the credit desk at the Bank of Montreal (BMO). The job will start June 1. It pays a base salary of $125,000 per year and Xiaoning will be eligible for a bonus. The expected bonus is 10%, 30% and 50% of base salary, payable in March following the end of each year. As of June 1, Xiaoning will have about $25,000 in cash in the bank, but no other assets.

BMO will withhold 30% of his pay for taxes each month, and 10% for benefits including medical, dental, vision, and the rest of the BMO standard executive package. The package is not mandatory, but BMO subsidizes the cost to make it a clear choice compared to commercial alternatives. Optional term life insurance pays $500,000 to his family in the event of his death. It costs $500 per month. His probability of surviving every month can be estimated from actuarial tables at 99.5% per month for the next three years. BMO also provides a $100,000 line of credit to Xiaoning with a borrowing cost of 6% per year, in case Xiaoning needs to borrow to cover his expenses.

Xiaoning will be taxed as an American citizen, paying U.S. federal taxes, NY state taxes and NYC taxes. You may assume that taxes are filed and paid at the end of each year. Three months into the next year, he will either have to pay any amounts owed, or will receive a rebate check from the relevant government entities, deposited directly into his checking account. Xiaoning will likely take the standard deduction for a single person.

Xiaoning has identified an attractive apartment for rent at $3500 per month. He will take the subway for $80 per month to work, since it is much cheaper and faster than parking in NYC. However, he must have a car for weekend getaways to the beaches and summer parties in the Hamptons, hiking the Adirondacks in Upstate New York, experiencing U.S. history and seeing his college friends in Boston or attending peaceful protests in Washington D.C. Without a car, his estimated rental costs would be $450 per month. A car would cost $25,000. However, the car requires $200 per month in insurance, and an average of $100 per month in repairs. The car can be 80% financed with 2 points of fees at 6.5% (fees would be financed as well), or 90% financed with no points but 7% interest. Car loans are for 5 years. The car can be sold after three years for an estimated salvage value of $18,000. Also, Xiaoning will have to pay $350 a month in parking fees if he keeps a car at the apartment complex.

Xiaoning may buy renters insurance for his apartment at a cost of $800 per year, paid at the beginning of each year. If he doesn't buy insurance, he believes that his expected losses are around $300 per year. Also, Xiaoning has the option to buy the apartment in Brooklyn for $600,000. If he buys the apartment, he can get a 90% financed mortgage at 5% per year with one point, also financed. Mortgage interest is computed annually and is tax deductible, but principal payments are not. He expects the apartment to grow in value by 8% per year, but assuming he has to sell it after three years, he will have to pay real estate fees of 6% and closing costs of $8000. If he gets a mortgage, he must buy insurance on the property for $2000 per year, and he believes his expected losses are $600 per year.

Xiaoning can keep his money in the bank earning 0.10% interest, or can invest in the S&P500 with an expected return of 10% per year.

2021 U.S. Federal Tax Brackets and Tax Rates (for filing in 2022)

Single

If taxable income is over:	but not over:	the tax is:
$0	$9,950	10% of the amount over $0
$9,950	$40,525	$995 plus 12% of the amount over $9,950
$40,525	$86,375	$4,664 plus 22% of the amount over $40,525
$86,375	$164,925	$14,751 plus 24% of the amount over $86,375
$164,925	$209,425	$33,603 plus 32% of the amount over $164,925
$209,425	$523,600	$47,843 plus 35% of the amount over $209,425
$523,600	no limit	$157,804 plus 37% of the amount over $523,600

Questions:

Develop an Excel spreadsheet pro-forma (forecasted financial statement) to model Xiaoning's decisions. Answer the following questions using your spreadsheet. Use only expected values to draw any conclusions, i.e. no risk adjustments.

1. What criterion should Xiaoning use to make his decisions?
2. Based on your criterion, should Xiaoning buy term life insurance?
3. Should he borrow on his line of credit?
4. Should he rent an apartment, or buy a house?
5. Should he rent a car or buy a car? If he buys a car, which financing package is better?
6. Should he buy renters insurance?
7. Should he invest in the S&P 500?

Do you believe your analysis is providing the correct recommendations for Xiaoning?