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Factor Frenzy Answer Sheet
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1. What are your stocks (5-10 holdings) and optimized weights?

	Ticker Symbol	Portfolio Weight	Current Market Cap
1	CROX	5%	7.671B
2	APPS	5%	1.164B
3	LSCC	42%	10.967B
4	CELH	43%	7.331B
5	ENPH	5%	22.503B
6			
7			
8			
9			
10			

2. A. Did your portfolio create alpha in either specification (FF3 or FF5 factor)? How much? Explain what this conclusion means. (4-6 sentences) *Note: portfolios that do not create alpha will receive 0 points for question #2.*

   The alpha of the FF 5-factor model is **0.058**, and the alpha of the FF 3-factor model is **0.052**. The alpha in the Fama-French model is the investment performance that cannot be accounted for by the variables in the model. An investment has exceeded its projected return based on model factors if the alpha is positive. Alpha, then, is the share of return that can be attributed to an investor's or fund manager's competence rather than to larger market or risk variables.

   B. Input the results of your regressions here.

Model	Alpha	Significance (p-value)
FF 3 Factor	0.052	0.0001
FF 5 Factor	0.058	0.0000

3. Does the FF 5 Factor model add any explanatory power over the FF 3 Factor (use a 10% significance level if needed)? How do you know? What does this mean for your risk analysis? (5-7 sentences)

   No, by conducting the F-test to test whether the beta of RMW and CMA is useful to explain the excess return of the portfolio, the p-value is 0.367, larger than 10%, which means that among these two extra variables might not lead to a statistically significant improvement in explaining the variations in stock returns compared to the 3 Factor model.

In terms of risk analysis, this implies that the 3 Factor model may be sufficient for capturing most of the relevant risk factors in the given dataset. The 5 Factor model, while providing additional factors, might not provide enough incremental benefit to justify its use in this case.

4. Using the FF3 Factor results.
    a. What were the coefficients and significance on the three factors?

Factor	Coefficient	Significance (p-value)
MKT-RF	1.481	0.000
SMB	1.389	0.005
HML	-0.889	0.004

    b. Where would your portfolio plot on a size (vertical) and BTM (horizontal) style box? (use a 10% significance level, place an x in the correct yellow box)

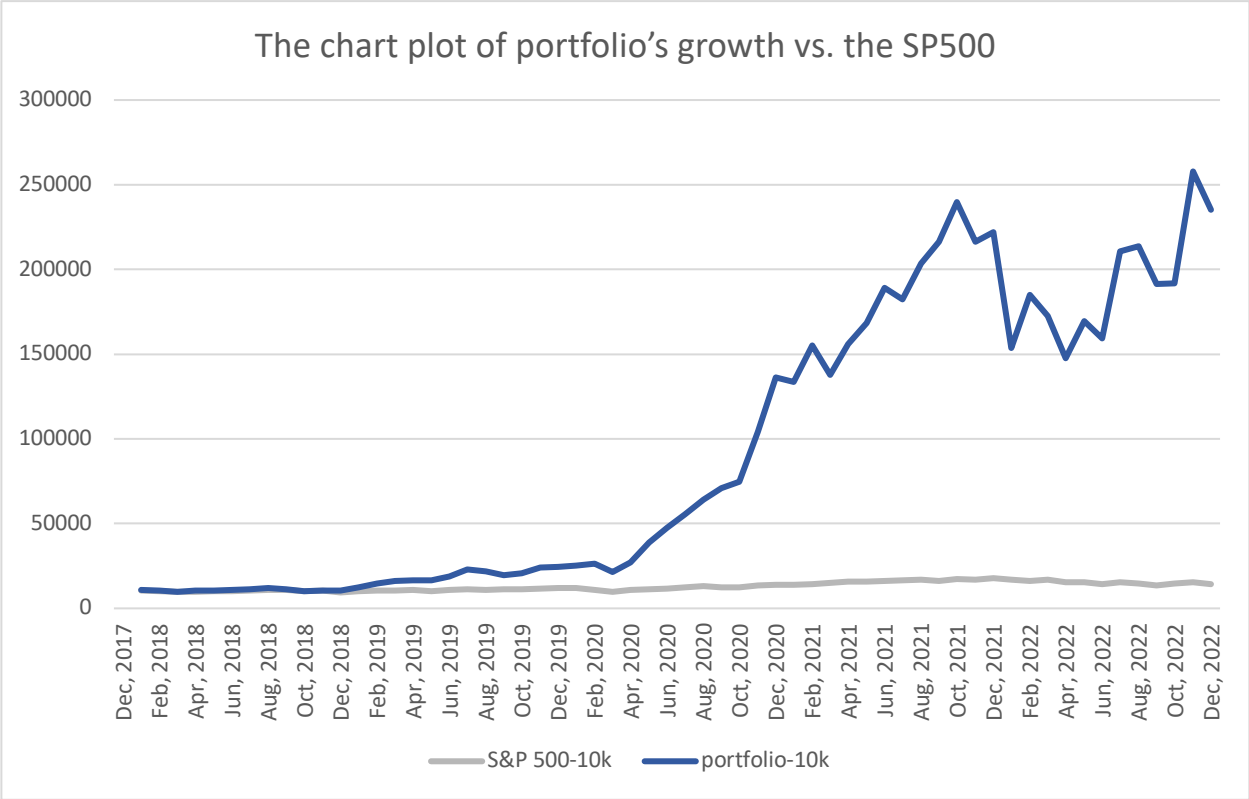
	High		Low
Small			**x**
Big			

At the 10% significance level, the coefficient of SMB is significantly positive and the coefficient of HML is significantly negative. A negative HML coefficient implies that the portfolio is tilted towards growth stocks (low book-to-market), while a positive SMB coefficient indicates a preference for small-cap stocks.

5. What would the value of a $10,000 account be if a client invested in your fund for the 5 years? *Assume the client starts the investment on January 1st 2017. So the value for January 2017 would be $10,000 * (1+ Return January). For February 2017 it would be Value January * (1+ Return February). Continue this for 60 months until December 2021 for your ending value.*

235,269.96

    a. Provide a plot of your fund's growth vs. the SP500 (ticker: ^GSPC on Yahoo!). *Repeat the process above for the S&P500's returns and value starting with $10,000 to create another column in your spreadsheet. This line graph should have two lines both starting at $10,000. See the Morningstar link on page 1 for an example. Yahoo! doesn't give the option to download this data, but you can copy and paste the whole table right into Excel.*



6. What is the 5% VaR of your $10,000 portfolio? (using last 5 years)

Portfolio Average Return	6.34%
Portfolio Standard Deviation	14.24%
5% VaR	1707.89

7. Provide five <u>other</u> statistical measures (not calculated above) to help your clients understand more about your fund. Use the last five years of data and be careful pick and explain statistics that you believe will help a "non-quant" client. *i.e. MSE or the standard error of one of your factors is not going to help explain your portfolio.*

Statistical Measure Name	**Data**	**Reason for inclusion, Interpretation of statistic**
Example: Portfolio Standard Deviation	*15%*	*Helps investors understand total risk of the investment. Useful for explaining the probability of loss and value at risk. Allows return to be scaled by a risk measure. Assuming a normal distribution, a standard deviation of 15% means that 68% of the time you should expect this portfolio to have a return +/- 15% from the mean.*
Sharpe ratio	43.85%	The Sharpe ratio is a measure used to evaluate the performance of an investment

		by considering both its returns and the risk involved. It tells you how much return you can expect for each unit of risk taken. For this Portfolio, a Sharpe Ratio suggests that the fund has generated a return of 43.85% above the risk-free rate for each unit of risk taken over the period of 2018 to 2022.This portfolio has performed well compared to the level of risk involved.
Kurtosis	0.470	Kurtosis helps to understand the nature of return fluctuations and assess the risk of extreme returns. The portfolio has an excess kurtosis of 0.47 indicating a somewhat more peaked distribution with slightly fatter tails. This suggests that the portfolio's return distribution might have a marginally higher probability of extreme returns (both positive and negative) compared to a perfectly normal distribution
Skewness	0.318	Skewness helps to understand the return distribution of a portfolio. The portfolio has a skewness of 0.318, which indicates a positive skewness. This means that the portfolio's return distribution has a longer right tail, suggesting a slightly higher probability of positive extreme returns than negative extreme returns.
Compound Annual Growth Rate (CAGR)	84.82%	The compound annual growth rate of the portfolio over the past five years is 84.82%, which means that the value of investments has increased by an average of 84.82% per year during this period. This is an impressive rate of return because it means that the investment continues to grow year after year.
Maximum Drawdown	-38.45%	Maximum drawdown is a risk indicator that measures the performance of a portfolio over a period of time, representing the percentage of maximum value loss between the fall of a portfolio from its highest point to its lowest point. The maximum drawdown helps investors understand the maximum losses that the portfolio is likely to suffer over the past period. The maximum drawdown of our portfolio is -38.45%, which means that, historically, the largest decline in the

		portfolio's value from its peak to its lowest point was 38.45%.