

## **XACBANK KNOWLEDGE TEST**

**Unit:** Modelling and analytics division

**Deliverable:** Your GitHub repository URL

**Deadline:** 2020/09/07 07:00 AM, ULAT

**Submit address:** to: recruiter@xacbank.mn, cc: sugarkhuu.r@xacbank.mn

Hey there!

We, at XacBank, are excited to know that you are interested in working with us. As the next stage of the selection process, we invite you to complete the following tasks.

The test consists of 3 questions in English and 1 essay question in Mongolian for a total of 35 points. Answers must be written in English except the essay question. You are supposed to place all your results in your GitHub repo that you will be creating in the first question. Answers can be in separate files question by question or whatever format that is easy for others to understand. Feel free to choose the answer format. Clarity, good organization and creativity of your answers can be used as an argument in favor of you in the latter rounds of selection.

Please try to get as much score as you can. You will be ranked against your competitors by your total score. You are allowed to ask anybody or anything (including "Google") for help for completing the tasks. But you should make sure that you grasp everything while doing as we would check your knowledge on the later stages of the selection process if we happen to see each other then. What you already know is important, but what you can learn might be more important in the end of the day. There might be more than one correct answer to some questions. Thus, if you happen to choose one over another, please don't forget to provide a clear explanation.

Good luck!

1. Read the following article carefully for the tasks below in this question. 10 points.

<https://towardsdatascience.com/building-a-logistic-regression-in-python-step-by-step-becd4d56c9c8>

- a. Create a GitHub account, if you don't have one already. 0.5 points.
- b. Create a new Git repository (obviously, it should be "public" so that others can see it) on your GitHub account. Name it "XacBankJobExam". 1 point.
- c. Add the ".csv" data file used in the article above to your "XacBankJobExam" repository. 1 point.
- d. Create a jupyter notebook (".ipynb" file) the same as the one that is used in the article.

Note: You should not fork the repository of the article. It should be created on your local machine. 2 points.

Run your jupyter notebook on your local machine. Now you will be asked to do 2 edits to your jupyter notebook created above.

- e. Explain in the beginning of your notebook above that you copied and are using someone else's notebook and mention the owner's GitHub account there. 0.5 points.
- f. In the very end of your notebook, explain what the "logit\_roc\_auc" score in the code (AUC or AUROC) score in general measures and what ROC curve shows. Explain also whether this particular model is good at classifying based on the AUC score and ROC curve shape. 2.5 points.
- g. Run the whole notebook and save it. Your notebook should be saved with all the outputs printed. Then commit your changes. You may face some errors if you have some packages not installed when running the notebook. If so, of course, install them. 2.5 points.

2. Please answer simple economic questions in this task. 10 points.

a. What is the price of a kilo of beef in China now (in CNY)? Please indicate your source. 0.5 points.

b. What is the price of a kilo of beef in Mongolia now (in MNT)? Please indicate your source. 0.5 points.

Let us assume that there is no additional cost if you buy beef from either China or Mongolia and it will arrive at your home in an instant in either case. Furthermore, the quality or everything is just the same between the two options. Then it must be much cheaper to buy in Mongolia, right?

c. So, the market is not in equilibrium and the Chinese will start buying from Mongolia. If we assume the prices in either China and Mongolia is fixed, then the only variable, let's be very simple, which can change to restore the equilibrium is the exchange rate. What should be the MNT per CNY exchange rate (CNYMNT) so that beef costs the same in both countries? How many percent does it mean that the MNT should appreciate against CNY (MNT should appreciate since beef is too cheap in Mongolia)? Please write down your calculation details. 1 point.

Now let assume that we are in the beginning of 2021. Beef prices in local currencies are still the same (as in "a" and "b" each) in both countries and the CNYMNT is at the level that was the result of the question "c". Other assumptions are kept.

d. What was the average annual CPI inflation rate in China between 2010 and 2019? Please indicate your source. 1 point.

e. What was the average annual CPI inflation rate in Mongolia between 2010 and 2019? Please indicate your source. 1 point.

f. What will be the price of beef in China in Sep 2025 (5 years from now) assuming that it will grow at 2010-19 average inflation rate of China? Please write down your calculation details. 0.5 points.

g. What will be the price of beef in Mongolia in Sep 2025 (5 years from now) assuming that it will grow at 2010-19 average inflation rate of Mongolia? Please write down your calculation details. 0.5 points.

h. Where is it in 2025 cheaper to buy beef? Please write down your calculation details. 1 points.

i. Assuming the same thing as in "c" happens, what should be the CNYMNT rate? Please write down your calculation details. 0.5 points.

j. If inflation in Mongolia was twice higher than what you got in "e", what will be your answer to "i"? Please write down your calculation details. 0.5 points.

k. What was the average depreciation of MNT against CNY between 2010 and 2019 (in %)? Please indicate your source. 1 point.

l. Can you make a conclusion based on your findings above, especially on "j" and "k"? 2 points.

3. Please work on the following accounting and finance questions. 10 points.

3.1. **[Bank accounting]**[2 points]: Let us assume that you have just opened a deposit account of one year tenor at XacBank and transferred 1 million MNT into it from your current account at Xacbank. Please see the interest rate on XacBank's website.

- a. What will be the journal entries on your book on the first day for the transaction? 0.5 point.
- b. What will be the journal entries on Xacbank's book for the transaction? 0.25 point.
- c. What will be the journal entries when the first interest is accrued in one month (on Xacbank's book)? 0.25 points.
- d. What will be the journal entries when the sixth interest is accrued in six months (note that Xacbank does compounding, on Xacbank's book)? 0.5 points.
- e. What will be the journal entries when the deposit expires in one year and you receive the outstanding amount to your current account at XacBank (on Xacbank's book)? 0.5 point.

3.2. **[Bond pricing]**[2 points]: Find the ask yield-to-maturity of a bond with the following characteristics:

- Par value: \$100
- Coupon rate: 5% per annum
- Coupon frequency: Semi-annual
- Bid/ask price: \$96.5/97.5
- Remaining maturity: 5 years

Please write down your calculation details.

3.3. **[Short sell]**[2 points]: ABC stock is selling \$10 per share. You believe that it is overvalued and will soon drop to \$9 per share. Why not short it?, you thought. Therefore, you decided to try your luck by shorting 5000 shares. Let's see what can happen.

Parameters: Initial margin is 50%. Maintenance margin requirement is 30%. Broker's fee is 0.5% of the transaction value due in each trade (for sales and purchases of

stocks). Call loan rate that your broker charges for the fund she lent you is 1.25% per annum.

- a. How much are you required to put as an initial margin deposit? Please write down your calculation details. 0.25 points.
- b. Starting at what price, you will get a margin call? 0.25 points.
- c. If price increased to \$13 per share, how much will you be asked to deposit to reach maintenance margin requirement? 0.5 points.
- d. If you closed the deal when price was \$9 per share after 6 months as you expected, what will be your annualized rate of return (assume nothing happened in between to incur additional cost)? 0.5 points.
- e. If you closed the deal when price was \$11 per share after 6 months, what will be your annualized rate of return (assume nothing happened in between to incur additional cost)? 0.5 points.

3.4. **[Cross-currency swap][2 points]:** Imagine A and B companies enter into a USD-MNT swap agreement on 25 August 2020. At the first leg, the company A paid 1 million USD to the company B and the company B paid 2.85 billion MNT to the company A. The notional amounts will be exchanged in the end of the contract which is on 25 February 2023. Interest for USD is 6M USD Libor + 100 basis points and for MNT policy rate of Bank of Mongolia (BoM) + 50 basis points. Interest rate will be fixed at the start of every 6 months and the interest will be exchanged at the end of every 6 months (reset date).

- a. Create a trajectory for 6M USD Libor, the policy rate of BoM and USDMNT exchange rate for the next three years on the reset dates of interest rates (3 variables). Obviously, these must not be random numbers, thus, please provide your rationale for each. 0.5 points.
- b. Based on your result in "a", write down the detailed cash flows of MNT and USD sides. 0.5 points.
- c. Which company is likely to gain more from more MNT depreciation, and why? 1 point.

3.5. **[Option related][2 points]:**

a. As an investment consultant, how will you construct a discount certificate with strike price of \$56 and cap at \$60? 1 point.

b. You are still an investment consultant. Many of your customers expect the Deutsche Bank to recover from its mishaps of the recent years and its stock price will rise. Thus, they want you to sell a call option on Deutsche Bank. Assuming the strike price will be 8 euro, time to maturity is 6 months, interest rate is 0.5% and sigma is 3, calculate the price of the European call option. We leave the task to find the spot price to you.

For that, please use the function "euro\_vanilla" in the following article:

<https://aaronshlegel.me/black-scholes-formula-python.html>

1 point.

4. "Харилцааны ур чадвар нь ажил хэргийг амжилттай явуулахын үндэс болох нь" сэдэвт эсээ (essay) бичнэ үү. Үгийн тоо хамаарахгүй. 5 points.

**END**