**Segment A. Mathematics Test**

1. Which of the following states contributed approximately 25% of the combined production of all the 4 country in the year 2002?

**Answer: a. Indonesia**

Total: 22+19+26+11+13= 91

Indonesia: 22/91 = **24.18%**

Singapore: 19/91 = 20.88%

Malaysia: 26/91 = 28.57%

Thailand: 11/91 = 12.1%

Philippines: 13/91 = 14.29%

2. What was the difference in volumes exported in 1997 and 1998?

**Answer: d. 10,000,000 kg**

1997 = 150,000,000 kg

1998 = 160,000,000 kg

Difference = 160-150 = **10,000,000 kg**

1. In which year was the value per kg the least?

1995: 150/100 = **1.5**

1996: 150/75 = 2.0

1997: 330/150 = 2.2

1998: 400/160 = 2.5

1999: 500/200 = 2.5

**Answer: a. 1995**

1. Which of the following statements is/are true regarding the consumption of chocobar?  
   (in ‘000 bars)

1993 to 1994: 118-124 = -6,000

1994 to 1995: 128-118 = 10,000

**1995 to 1996: 92-128 = -36,000**

**1996 to 1997: 134 -92 = 42,000**

1997 to 1998: 126-134 = -8,000

1998 to 1999: 122 – 126 = -4,000

**Answer: c. The steepest fall in the consumption of chocobar follows the steepest increase in consumption.**

5. Over the period 1993-94 to 1997-98, there has been a/an \_\_\_\_\_ in fertiliser subsidy.

Data from 93 to 98:

Indigenous fertiliser: 3000, 3400, 3350, 3300, 4800

Imported fertiliser: 200, 1142, 1039, 1499, 1000

**Answer: d. Inconsistent Expenditure.**

6. In which year was the bank credit per sick unit the maximum?

Bank credit/sick unit on each year ($ billions/’000s sick unit):

1996: 0.75

1997: 0.666

1998: 0.4167

1999: 0.3875

2000: 0.4

**Answer: a. 1996**

7. For strategy genre, in which year was the ratio of rejection to production the highest among the given years?

To find: ratio of **rejection** to **production**

1995: 0.06

1996: 0.0444

**1997: 0.0625**

1998: 0.05476

1999: 0.0521

2000: 0.05122

**Answer: c. 1997**

8. What is the ratio of the distribution of proteins in the muscles to that of proteins in the bones?

Distribution of proteins in muscles: 1/3

Distribution of proteins in the bones: 1/6

1/3:1/6 = 2:1

**Answer: b. 2:1**

**Segment B. SQL Query Test**

\*Note: My answer will be attached as “agate2.sql” but the overall input & output will be written here.

\*\*The output result is based on the dummy data provided.

1. Create an SQL query that shows the TOP 3 authors who sold the least books in total.

**Answer:**

**SELECT author\_name, SUM(sold\_copies) as total\_sold FROM authors a**

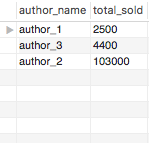
**LEFT JOIN books b on a.book\_name = b.book\_name**

**GROUP BY author\_name**

**ORDER BY total\_sold ASC**

**LIMIT 3;**

**Output:**

****

2. Write an SQL query to find out how many users inserted more than 2000 but less than 4000 images in their presentations!

**Answer:**

SELECT

COUNT(user\_id) AS no\_of\_unique\_users

FROM

(SELECT

user\_id, COUNT(event\_date\_time) AS times\_inserted

FROM

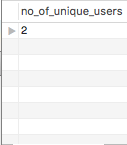
event\_log

GROUP BY user\_id

HAVING (COUNT(event\_date\_time) < 4000

AND COUNT(event\_date\_time) > 2000)) AS T;

**Output:**

****

3. Print every **department** where the **average salary** per **employee** is **over than** **500$!**

**Answer:**

1. To display the department\_name that fulfill the requirements (avg(salary) > 500) **only** and sorted by the average salary the query used will be**:**

**Query input a:**

SELECT

department\_name

FROM

(SELECT

department\_name,

CAST(AVG(salary) AS DECIMAL (10 , 2 )) AS average\_sal

FROM

employees e

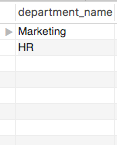
LEFT JOIN salaries s ON e.employee\_id = s.employee\_id

GROUP BY department\_name

HAVING (average\_sal > 500)) AS T

ORDER BY average\_sal;

**Output a:**

****

1. To display the department\_name and the average salary sorted by average salary the query used will be:

**Query input b:**

SELECT

department\_name,

CAST(AVG(salary) AS DECIMAL (10 , 2 )) AS average\_sal

FROM

employees e

LEFT JOIN

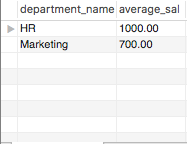
salaries s ON e.employee\_id = s.employee\_id

GROUP BY department\_name

HAVING (average\_sal > 500)

ORDER BY average\_sal DESC;

**Output b:**

****

1. Create SQL Query that **show Person Data** with each their **Deposito Amount**. Data sorted by **PERSON\_ID.**

**Answer**

**Query Input:**

SELECT

d.deposito\_id, d.amount, p.person\_id, p.name AS person\_name

FROM

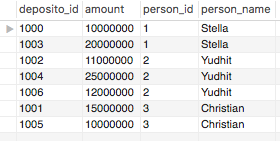
agate\_person p

LEFT JOIN

agate\_deposito d ON d.person\_id = p.person\_id

ORDER BY person\_id;

**Output:**

****

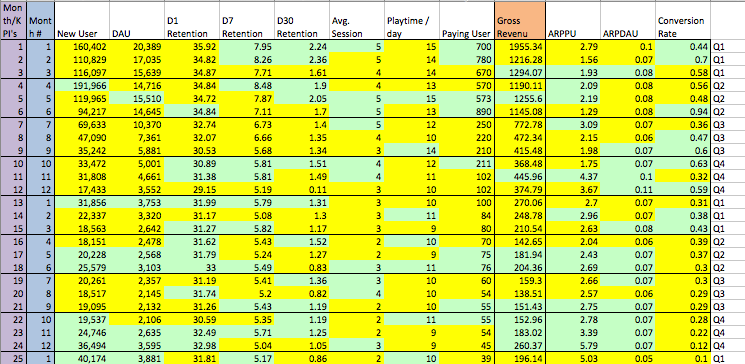
**Segment C. Study Case**

1. What do you think is **2 most important KPI’s** that Tim must know to **increase Game X Revenue?**

Based on several sources, it is stated that some KPI’s that need to be considered towards the performance of game development are Engagement KPI’s, Financial KPI’s, User Experience KPI’s, Mobile App Marketing API’s, and App Store Optimization. The factors that are included on each KPI are as follow:

* *Engagement KPI’s* : Retention Rate, Sessions, Session Length, Session Interval, Session Depth, Avg. Screens per Visit, DAU, MAU, Social Shares (Banner, Video?), Brand Awareness, Churn Rate
* *Revenue-Focused/Financial KPI’s:* ARPU (Avg. Revenue Per User; IAP, ads, subs, paid downloads), Lifetime Value (LTV), Time to First Purchase, Purchases, Customer Acquisition Cost (CAC), Cost Per Acquisition (CPA), Customer Lifetime Value (CLV), eCAC (Effective Customer Acquisition Cost), eCPM (Effective Cost Per Mille), Paid Conversion Rate, Organic Conversion Rate, Return on Investment (ROI), Cost Per Install.
* *User Experience KPI’s* : Load Time**,** OS, Devices, Carriers (important), Screen Dimension/Resolution, Permissions Granted, API Latency
* *Mobile App Marketing KPI’s*: Install Source (for marketing campaign), Channel Breakdown, Geo-metrics, Demographics, Cohort Analysis, Behavioral Metrics
* *App Store Optimization (ASO):* Keywords, App Store Category Ranking, Views to Installs, Reviews

From data given for Game X, it seems like the team had been focusing too much on acquiring new user; whereas it doesn’t really impact the revenue unless the number of paying users increased too. Here’s the full table marked with the increase and decrease of each features:



Where the yellow-marked row means decrease from the previous month, and green means increment. From 25 months of running, only 9 specific months give an increase in Gross Revenue. From here, I made a new table to make it easier to see the patterns of features that affect the target (Gross Revenue). 1 indicating increase, 0 no effects/decrease, and 0.5 means stagnant value from previous month.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Month | ARPPU | ARPDAU | DAU | D7Retention | D30Retention | Avg. Session | Playtime/day | Paying Users | New Users | Total Features/Month |
| 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 5 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 6 |
| 11 | 1 | 1 | 0 | 0 | 0.5 | 0 | 0.5 | 0 | 0 | 3 |
| 17 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 5 |
| 18 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 8 |
| 21 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 5 |
| 22 | 1 | 1 | 0 |  | 1 | 0 | 1 | 1 | 1 | 6 |
| 23 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 6 |
| 24 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 5 |
| Total | 9 | 8 | 5 | 3 | 4.5 | 3 | 3.5 | 5 | 5 |  |

From here we can see that most features that affects the Gross Revenue are ARPPU and ARPDAU. However, ARPPU and ARPDAU will be high if the Gross Revenue is small, most of the time if revenue increased ARPPU and ARPDAU will increase too. Increase in ARPDAU doesn’t necessarily affect by increase in DAU and slight increase in PU will increase the ARPPU, so we will neglect this.

Looking at the three top features are Paying Users, New Users, and DAU. New Users will not influence the revenue significantly, since we can see from the first table that when ARPDAU increase (which is affected by increase in DAU), Gross Revenue not always increased. So from these 3 the most influential feature towards Gross Revenue will be Paying Users. If Paying Users (PU) increased in number, Gross Revenue most likely increases too. Daily Active Users don’t really give high revenue, probably since the revenue obtained from there are only from advertising. Not all DAU will purchase in-app-purchases. However, when PU purchased items or characters, the revenue will straight go to the revenue.

Second will be Retention, especially Retention after 30 days. It is stated in the case study that the higher the retention, which is affected by playtime as well as average session, the higher chance a user will spend money in purchasing items. It will be much more help if there is data for Retention in the middle of 7 and 30 days, so we can examine what makes users quit/uninstall the game. The higher R30 the more opportunity a user will become paying users.

In conclusion 2 KPIs Tim needs to pay attention to are:

1. Paying Users
2. Retention after 30 Days

There will be much help too if Tim could get Cost Per Acquisition to check the efficiency of Marketing Campaign, since the higher number of New Users, the more probability of converting them into Paying Users. Other aspect to be considered is Stickiness, which can be calculated by dividing Daily Active Users with Monthly Active Users. The higher the stickiness, the more Tim could know the addictivity of Game X, which will also influence the performance.

1. What do you thinkis **the problem of Game X?**

To explain the problem of Game X, I think there are two major problems. First, the problem of Game X is between the management. The resignation of the previous PM shouldn’t have stopped the campaign. Although not explained in specific detail, we can see that overall the paid users in 2018 dropped very low comparing to the paid users from 2017. From the User Acquisition Media, none of the campaigns seem to reach more than 10,000 users. Which in 2017 considered the lowest. The changes in acquisition media affect a lot towards the new user results. Although, the new users acquisition doesn’t influence heavily upon the revenue as much as the loyal users, there are certain aspects that are impacted by the new users, such as the Engagement KPI’s. By having more new users, mean there’ll be more chances to increase the brand awareness towards the public. Also, it seems like the new campaign (2018) didn’t go in sync with the events implemented in the game, thus making the revenue very low. There must be a balance between the campaign as well as the events & IAP, to get a better retention. There needs to be a more detailed data on the Cost per Acquisition for each campaign.

Second important aspect is the user experience. New users tend to have less patience than active loyal users or paying users. They wanted to know how the game will be, thus the increase in size affect the loading screen before playing. In 2018, size is increased and registration is added more, making new users churn rate high. Splash screen to download data create a 33.33% churn rate, followed by downloading data to registration another 20%. Once the user gets into the Tutorial 1, there was only 46.6% users left since when they enter the game. This means about half the users left before even trying the tutorials. Making Tutorial 2 (Funnel 2018) harder seems to work, with users wanted to leave after Tutorial 2 only less than 1%. However, from Tutorial 1 to Tutorial 2 there were already 16.67% users left. Perhaps there should be an option whether a user could choose if they want to go for another Tutorial or straight to Home Screen.

1. What suggestion will you give as data analyst to help Tim increase both **Performance and Revenue?**

* Increase the addictivity/stickiness of the game play.
* Add more interesting In-App-Purchases.
* Better User Experience.
* Make simultaneously effectivity between the events implemented as well as marketing campaigns, to ensure that there are high number of new users along with high number of paying users. Also the bonus is getting the brand awareness to the public.

Mostly, the problem that makes Game X didn’t function well is the **marketing campaigns that were stopped** **and not synchronized with the events/In-App-Purchase in the game, the game play or the funnel section;** which include the experience of new users as well as paying users.

To increase performance, perhaps there must be a faster splash screen and least download data and easier registration, then followed by a very interesting Tutorial 1. After the Tutorial 1 is done, give users option to go straight to Home Screen with the option of opening Tutorial 2 and 3 later on if they feel like they need to after experiencing the real game, or go to Tutorial 2. This will increase the %Churn of users, and also adds higher retention after days.

In order to increase the Revenue, having the above steps will add a better performance in Retention, which is 1 of the KPI’s I believed, is very influential. After that, interesting events and in-app-purchase will make the Active Users become Paying Users. Adding extra dungeons seems to be an effective way to keep users engaged too, based on Development Log. It is proved to increase the Average Session, perhaps due to the unability of users to save mode (if that’s the case), and interesting new enemies to battle with. Also the same effects with adding new playable/gacha characters. There must also be a better coordination in implementing marketing campaigns and new characters/programs/events in the game. For example, if there will be events in March, Game X should bring new characters in the beginning of February and Marketing Division should start the marketing campaign in February. This has to be planned with annual budget, to make sure both the amount of New Users and Paying Users increased. The most effective way of User Acquisition seems to be Banner and Video altogether, so perhaps only implement that in the months where Revenue starts to decrease, such as in Q3 or Q4. In the more stable months, use cheaper user acquisitions.

New Users Behaviour Towards Conversion Rate

a. New Users

In 2017, New User (NU) reached peak on April ’17 at 191,966 users. Based on the User Acquisition data from Marketing division this is probably due to using Video for the marketing campaign. After that, new user seems to steadily decrease until the end of the year. This means that the Marketing Campaigns implemented in June, October and November 2017, which is the combination between Banner, Video, and Carrousel, weren’t very effective. Perhaps the most effective way to acquiere new users are by Video campaign that were implemented in March.

By the end of 2017, the New Users acquired reach the lowest point for the 2 years of game run. In January 2018, it rised to almost 32,000 users, so perhaps the Banner and Carrousel implemented by Marketing Division in December ’17 combined with the New Year event as well as the easier Tutorial 2 worked well. It only increased until the end of January ’17, before steadily decrease again until April ’17. Based on the Marketing data, Banner was used in Feb ’18, which seems like it wasn’t a very effective campaign. After April ’18, it steadily increased until June ’18, which I think is due to the addition of more gacha character, dungeons, as well as events. NU dropped in July (also marketing campaign was Banner), but stayed on consistent number until September, before rising steadily until the end of the year. Overall, although so far from NU in 2017, there were a certain increase by the Q4 of 2018, and there weren’t any significant decrease as happened in 2017.

From here, we can conclude that new users are more likely to be attracted by using Video campaign. Banner and Carrousel only executed well when implemented along with some events in the game.

b. Conversion Rate

On the other hand, in certain months we can see some significant increase in Conversion Rate (CR). At the beginning it elevated very good from January to February 2017. Perhaps the “Season of Love” event worked really good. However, after that, we can see that there weren’t any activities in Development Log from March to May, which consequently affected the steady decrease CR until May ‘17.

In June 2017, CR reached the highest number, which is 0.94. That means only 6% of the NU decided to play free. Based on Development Log (DL), at the beginning of May ’17 Game X added more in-app-purchase and new Water Dungeon. This means the IAP and event worked efficiently. On July ‘17, it dropped very steep to 0.36 before increasing gradually from August until October. It is stated in DL that there were a lot of events during this time. In August ‘17, there were daily event in game, special holiday event, and special secret dungeon implementation. October ’17 had Halloween Event, which from the graph above it seems like it the events in October weren’t as effective as August. Since it declined half in November before rising double in December. The rise in Dec ’17 most probably due to the Christmas and NY event, and making Tutorial 2 become easier. The funnel section shows that only less than 1% of first experience user quitted the game.

Starting in January ’18 to March ’18, CR steadily increased. However, after March it started to decrease carefully. Although not significant, perhaps this is due to the addition of registration process in March 2018. The 100% increase in size by the middle of January seems to have effects in conversion rate, most probably new users started to question if the size of the game would be worth the data waste. After April, it steadily decreased by maintain the value in average. The significant decrease in conversion rate started to appear in Oct ’18. By the end of Q4, CR reached the lowest point, which is 0.12. From the funnel report, it is shown that 1/3 of the users deleted the app due to the Splash Screen and 1/5 from Registration. So we can conclude that the Registration and Size of apps influence the new users.

Conclusion:

* Most effective marketing campaign to acquire new users is by using Video. However, since it seems like it’s more costly, a better implementation on marketing budgeting should be planned very well. And there needs to be a very good communication in terms of timeline between the Developers and Marketers. Banners and Carrousels should be used only if Events are to be available in the game.
* The aspects that influence the churn rate a lot seems to be the user experience. Increase in loading time, rise in data waste, seems to be affecting the decrease in Conversion Rate. However, interesting events and in-app-purchase, as well as special characters are very influential towards CR. The more interesting the gameplay and/or user experience, the more users tend to convert.