

ANALYSIS OF ANDROID-BASED LOAN INSTALLMENT CALCULATION

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ABSTRACT

The research entitled "analysis of android-based loan installment calculation" aims to calculate the number of loan installments per month from the loan principal, interest rate, and a certain period of time. This research was conducted by creating an application program using the React Native language. The program that had been created was then installed on an android-based cellular phone.

The results showed that the calculation of loan installments could be done quickly, easily and instantly. Users just had to install the program on their cell phones and then they could use it immediately.

Keywords: Loan installment, smartphone, android.

INTRODUCTION

The recent technological developments have entered into most aspects of life. Almost all activities of daily life, businesses/companies, financial institutions, education, and organizations use computerized systems. On the other hand, in general, people are able to operate computers and cellular phones (cell phones) well. The use of mobile phones is not limited to communication only, but has developed into various daily life activities such as emails, chats, social media, business transactions and other applications.

Nowadays, buying goods on credit has become a "lifestyle" for some people. Many people buy goods on credit such as houses, cars, motorcycles, electronic equipment and others. In short, buying goods on credit has become a culture in our society.

Many traders/sellers offer goods on credit with a relatively low down payment (DP). For example, a motorbike dealer offers a down payment of only around Rp. 1.000.000,- for a motorbike that costs Rp. 20,000,000,- A car dealer offers a down payment of around Rp. 30,000,000, - for a car that costs Rp. 150,000,000,- For people who are not familiar with the calculation of installments, this can be a dilemma, because, on one hand, they can have the item they need quickly but, on the other hand, they have to pay for loan installments which may be relatively large.

Companies providing credit facilities (banks or leasings), sometimes have difficulty calculating the number of loan installments at a certain interest rate. Installments that are too high make them unable to compete in the market. While installments that are too cheap cause less than the maximum profit.

For the public or prospective buyers, sometimes they cannot calculate the number of installments for credit with a certain loan principal. This causes potential buyers to hesitate to buy on credit or worry that the installments are too high.

Large companies such as banks, non-bank financial institutions (LKBB) such as leasings or pawnshops, in general have developed their own application system to calculate the number of installments. This is because, from the financial point of view, they are able to develop the system, and from an operational point of view, the application is very much needed to support the effectiveness and efficiency of services.

For small companies that are not able to develop an application system for calculating loan installments, it will be difficult to calculate the number of installments. People who want to buy goods on credit, generally do not know how to calculate the number of loan installments for the goods they want to purchase.

Salespeople, in selling goods on credit (such as houses, cars, motorcycles) must make the simulation of installment calculations for potential buyers. Manually, loan installments are calculated by using installment tables and calculators, so it takes a relatively long time and sometimes the calculation results are less accurate.

Those who have applied for a loan at a conventional institution must be familiar with the term annuity. Annuities are basically already common in society, but some people are still not very familiar with them. When applying for credit at the bank, annuity may have been explained roughly in general. Annuity can be described as a payment process with a fixed amount over a certain period ^[1]

Smartphones are widely known to those who use cell phone. A smartphone is a mobile phone that has a high level of capability, sometimes resembling a computer ^[2]

The application system that will be created is designed to be installed on mobile phones, not on personal computers or laptops, so the Android-based one is chosen. The programming language chosen is React Native because it is easier to design the display and can be developed for iPhone-based phones.

In this description, the authors made an application on a cellphone to calculate the number of loan installments easily, quickly, practically, and accurately. The application made can be installed on Android-based mobile phones.

I. METHOD

This research was carried out in a laboratory or with a personal computer. In the experiment, a formulation and an example of calculating loan installments (annuity) will be made with variations in interest rates and loan periods.

Annuity is a series of fixed payments over a certain period of time.

Annuities can be divided into two, namely:

1. Ordinary annuities, which are the payments made at the end of each period.
2. Annuities in advance, which are the payments made at the beginning of each period.

The application is going to be made for an ordinary annuity. The formula for an ordinary annuity is as follows:

$$PV = \left[\frac{1 - (1 + i)^{-n}}{i} \right] \cdot A$$

$$A = \frac{PV}{\left[\frac{1 - (1 + i)^{-n}}{i} \right]}$$

Details:

PV : loan principal value.

A : annuity (installments or installments per period).

i : interest rate.

n : loan period (tenor).

II. LITERATURE REVIEW

Gradual payments or installments are often offered by merchants or financial institutions to help customers who do not have enough money to pay for the goods they buy, such as houses, cars, motorcycles and others. The lender agrees to receive a down payment at the beginning of the agreement and allows the customer to pay the remaining balance at an interest charge for a mutually agreed period by paying it gradually or in installments. In finance, loan installments are usually called annuities ^[3].

In the banking world, annuity is actually a term with 2 definitions, namely as a credit product and as a type of interest. But annuity, in literal sense of word, has the similar meaning, namely term installments with or without interest ^[4]

Annuity is a series of payments of the same amount at fixed time intervals. An ordinary annuity is an annuity whose payment is made at the end of a period (such as one month or one year), therefore it is also called a final annuity ^[5].

Annuity is a series of payments of a certain amount of money that is generally the same amount, with the same period for each payment. Examples of annuities include loan interest, deposit interest, bond interest, home loan installments, car loan installments, insurance premiums and others ^[6].

The factors that affect the number of installments are as follows:

1. Principal loan.

The principal of the loan relates to the present value of a loan. The greater the principal of the loan, the greater the installment of the loan is.

2. Interest rates.

Interest rates are related to the "price" of money. The higher the interest rate, the bigger the installment. Interest rates are expressed in percentages per year. Interest rates are divided into two, namely flat and effective.

3. Repayment period (tenor).

The longer the loan repayment period, the bigger the installments. Tenors are generally expressed in months, adjusted for monthly installments.

There are 2 types of annuities, namely ^[7]:

1. Ordinary annuities are payments made at the end of each period.

The formula for calculating the number of installments (A, annuity) is:

$$PV = \left[\frac{1 - (1 + i)^{-n}}{i} \right] \cdot A$$

$$A = \frac{PV}{\left[\frac{1 - (1 + i)^{-n}}{i} \right]}$$

2. Advance annuity, namely payments made at the beginning of each period.

The formula for calculating the number of installments (A, annuity) is:

$$PV = \left[\frac{1 - (1 + i)^{-n+1}}{i} + 1 \right] \cdot A$$

$$A = \frac{PV}{\left[\frac{1 - (1 + i)^{-n+1}}{i} + 1 \right]}$$

Details:

PV : loan principal value.

A : annuity (installments or installments per period).

i : interest rate.

n : loan period (tenor).

Installments are generally paid per month, so the interest rate is expressed in months and the term is also expressed in months.

In the credit system there are several fees charged to consumers, such as:

1. Provision fee.
2. Administration fee.
3. Guaranty assessment fee.
4. Insurance fee, et cetera.

The difference between an ordinary annuity and an annuity due is obvious on the first payment. If in an ordinary annuity the payment begins at the end of the first period, in an annuity due (beginning), the payment is made at the beginning of the period or today. Ordinary annuities are often used in general transactions in the society, after the agreement is completed, the first payment is made at the end of the period ^[8].

The purpose of annuity is to guarantee transactions from both the bank and the customer. Because in its stipulation, annuities take a "middle way" to make the position of the creditors and debtors balanced ^[9]

Annuity interest is one of the methods for calculating loan interest. The calculation with this method aims to make it easier for customers to pay installments every period ^[10]

The calculation of loan installments can be calculated using Microsoft Excel, but the application program is general in nature so it is not suitable for certain calculation needs.

Microsoft Excel (MS-Excel) is one of the programs from MS-Office. This application serves to process data in the form of text or numbers. Usually, this program is widely used in schools, campuses, and offices for administrative processing purposes ^[11]

Android is an operating system that is very popular in the society. Almost all sophisticated gadgets have an Android-based operating system, ranging from watches, handphones, tablet PCs, to cameras. Soon, android will even be implemented into the computer ^[12].

Android is software for mobile devices that includes an operating system, middleware and key applications. Application development on the Android platform uses the Java programming language. The core suite of Android applications includes an email client, SMS program, calendar, maps, browser, contacts and more ^[13]

The growth of the market for android-based devices encourages the growth of android-based application development. Android makes it easy for anyone to create applications. Android is a collection of software that contains libraries, debuggers (program error finding tools) and emulators (driver impersonators), documentations, sample codes and guides. Android can be used on several devices, including ^[14]:

1. *Smartphone*.
2. *Tablet*.
3. *Electronic book device*.
4. *Notebook*.
5. *MPS player*.
6. *internetTV*.

There are several advantages of Android compared to its competitors, including ^[15]:

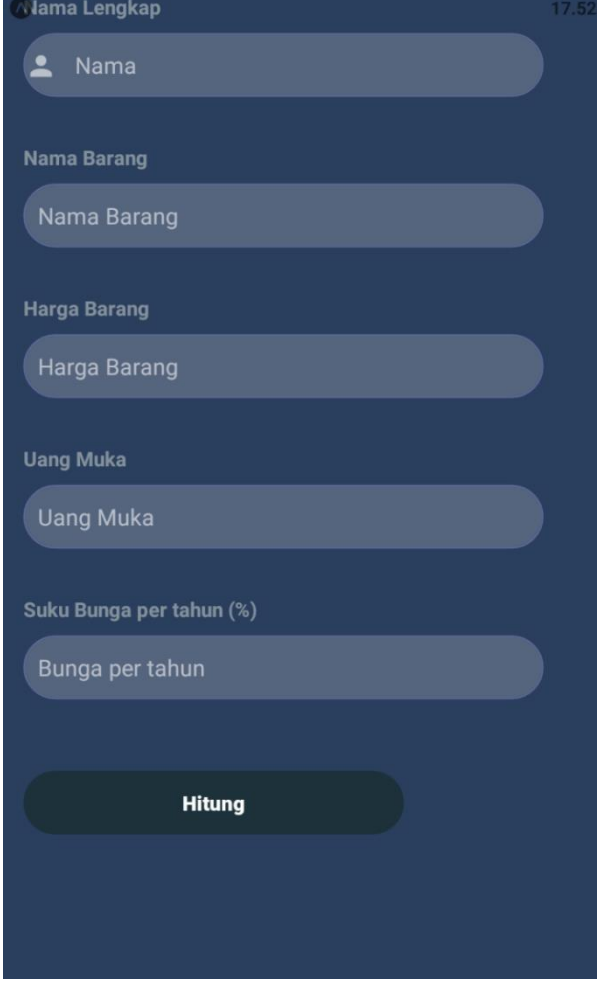
1. *User friendly*, android is very easy to operate, even those who cannot use android can operate it in a short time.
2. *Open-sourced*, android is built on the linux kernel, so anyone can develop and modify it without having to pay.
3. *accessible*, this operating system is suitable for various circles, from the lower class to the upper class can use it.
4. *well-supported with vast applications*, Android is supported with thousands or even millions of applications to support its performance.

Based on these advantages, it is not surprising that Android has become a very popular operating system and is favored by smartphone users.

The application that will be made is only based on the ordinary annuity formula above. The costs attached to credit at financial institutions are not taken into account.

III. DISCUSSION

The resulting application is run through the android platform. From this application, users can fill in the price of goods, down payment, and interest per year. After all data are filled in, when the calculate button is clicked, the application will display a simulation of the number of installments and a tenor of up to 15 years.



The screenshot shows the initial view of the application on an Android device. The status bar at the top displays 'Nama Lengkap' and the time '17.52'. The main interface consists of five input fields, each with a label and a placeholder text: 'Nama' (with a person icon), 'Nama Barang', 'Harga Barang', 'Uang Muka', and 'Suku Bunga per tahun (%)' (with 'Bunga per tahun' as the placeholder). Below these fields is a dark blue button labeled 'Hitung'.

Figure 3.1 Initial View of the Application

Nama : ardie halim		17.54
Nama Barang : Rumah		
Harga Barang : 300000000		
Uang Muka : 90000000		
Pokok pinjaman : 210000000		
Bunga Per Tahun : 15 %		
Bunga Per Bulan : 1.25 %		
Angsuran :	18954245.592483014	
Tenor :	12	
Angsuran :	10182196.089859746	
Tenor :	24	
Angsuran :	7279718.985880787	
Tenor :	36	
Angsuran :	5844457.135960028	
Tenor :	48	
Angsuran :	4995885.318135345	
Tenor :	60	
Angsuran :	4440452.80044059	
Tenor :	72	
Angsuran :	4052318.494430122	
Tenor :	84	
Angsuran :	3768535.1151096323	
Tenor :	96	
Angsuran :	3554110.8311874014	
Tenor :	108	
Angsuran :	3388024.008560317	

Figure 3.2. The application's result display

Angsuran : 4995885.318135345 Tenor : 60	17.54
Angsuran : 4440452.80044059 Tenor : 72	
Angsuran : 4052318.494430122 Tenor : 84	
Angsuran : 3768535.1151096323 Tenor : 96	
Angsuran : 3554110.8311874014 Tenor : 108	
Angsuran : 3388034.0985606317 Tenor : 120	
Angsuran : 3256921.4103604346 Tenor : 132	
Angsuran : 3151841.209075044 Tenor : 144	
Angsuran : 3066603.673288856 Tenor : 156	
Angsuran : 2996783.402565507 Tenor : 168	
Angsuran : 2939132.9493636056 Tenor : 180	

Figure 3.3. The application's result display 2

This study is limited to ordinary annuities where payments are made at the end of the period. The formula for calculating the amount of installments (A , annuity) is:

$$PV = \left[\frac{1 - (1+i)^{-n+1}}{i} + 1 \right] \cdot A$$

$$A = \frac{PV}{\left[\frac{1 - (1+i)^{-n+1}}{i} + 1 \right]}$$

Details:

PV : loan principal value.

A : annuity (installments or installments per period).

i : interest rate.

n : loan period (tenor).

Example :

If someone wants to buy a house at the price of Rp. 300,000,000, with a down payment of Rp. 90,000,000 and the rest is a loan at the bank with an interest rate of 15% per year. Then the installment calculation is as follows:

$$PV = \left[\frac{1 - (1+i)^{-n+1}}{i} + 1 \right] \cdot A$$

$$A = \frac{PV}{\left[\frac{1 - (1+i)^{-n+1}}{i} + 1 \right]}$$

PV = 300.000.000- 90.000.000 = 210.000.000.

i = 15% (year) or 1,25% = 0,0125 (month).

If the loan period (tenor) 12 months, therefore, the number of installments are

A = (210.000.000 / ((1-((1+1,25%)⁻¹²))/1,25%))

A = 18.954.245,59

The simulation result for several periods of time is as follows:

Table 3.1. Installment simulation table (random tenor).

No	Tenor (month)	Installment (Rp)
1	12	18.954.245,59
2	13	17.602.409,86
3	14	16.444.080,70
4	20	11.932.281,82
5	21	11.431.871,93
6	22	10.977.199,21
7	23	10.562.297,78
8	24	10.182.196,09
9	25	9.832.718,00
10	30	8.437.494,12
11	31	8.212.977,33
12	32	8.002.660,18
13	34	7.619.612,56
14	35	7.444.733,96
15	36	7.279.718,99
16	47	5.935.452,06
17	48	5.844.457,14
18	60	4.995.885,32

IV. CONCLUSION

From the results of the analysis, it can be concluded that:

1. The application system installed on Android-based mobile phones can be used to calculate the number of loan installments with varying loan principal, interest rates and time periods.
2. With the created application, loan installments can be calculated quickly, easily, practically and accurately.

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