

Creating a new algorithmic document collection

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Find this document in <http://elementsOfFinance.net/AlgorithmicDocumentGenerator.htm>

An algorithmic question scenario setup provides you with an endless stream of unique draws of random numbers, modifiers, words, any content than can populate a choice set. Complete the steps below to launch a new collection of algorithmic documents.

1. Start *Excel* and open the file

C:\Users\your username\Documents\Algogen\NewTitle\NewTitle.xls

If the file opens in “Protected View” then click the **Enable Editing** button that is toward the right in the yellow bar. If there is a security warning click the **Enable Content** button. On the worksheet tabs along the bottom be sure that the worksheet **AlgoMasterWS** is the active worksheet.

2. In cell **A2** type a description (or copy from here and paste in the cell) of the problem being created, for example, “Find the monthly loan payment for the simplest case”, and hit **Enter**.

-- In cell **B3** type or copy the formula “=randbetween(10,100)*1000”, hit **Enter**.

-- In cell **B4** enter “=choose(randbetween(1,4),2,4,5,10)”.

-- In cell **B5** enter “=randbetween(35,150)/1000”

-- In cell **B6** enter “=pmt(B5/12,B4*12,-B3)”

Cell **B6** is the answer for the question how much is the loan payment given the 3 determinants of a loan payment in **B3**, **B4**, and **B5**. Find below elaboration about the *Excel* question setup.

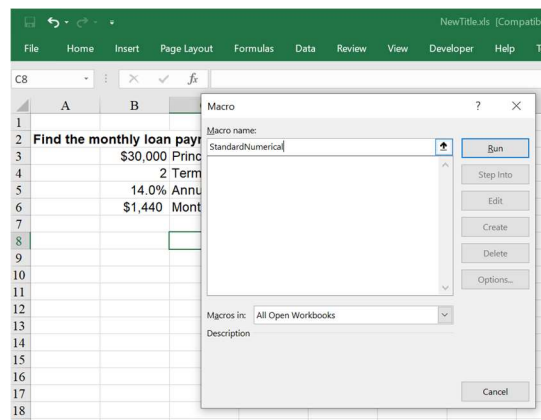
-- In cell **C3** type the label “Principal”. The number in **B3** is a minimum of 10,000 and maximum of 100,000 and any of the other 90 numbers (by thousands) in between. The **randbetween(a,b)** function is from the **Analysis ToolPak** add-in and returns a whole number from the inclusive range **a** to **b**. Formula **B3** multiplies that whole number by 1000 to get the principal amount of the loan.

-- In cell **C4** type “Term (years)”. The **choose()** function in **B4** has as its first argument an index, in this case any whole number from 1 to 4. The index specifies which of the subsequent choices (i.e., arguments) will be returned to the cell. That is, the term of the loan has a 1-in-4 chance of equaling a 2-year, 4-year, 5-year, or a 10-year loan.

-- In cell **C5** type “Annual interest rate”. The **randbetween()** function in **B5** returns a number from 35 to 150 which gets divided by 1000 meaning that the plausible interest rate is somewhere from 3.5% to 15.0% (by tenths).

-- In cell **C6** type “Monthly loan payment”. The monthly loan payment in **B6** computes from the *Excel* **pmt()** function. The first argument, **B5/12**, is the monthly interest rate found as the annual rate in **B5** divided by 12. The second argument, **B4*12**, is the number of monthly payments found as the number of years times 12. The third argument is the principal amount of the loan, **B3**, with a leading negative sign for peculiar *Excel* reasons. Cell **B6** shows the answer to the question.

To link this *Excel* spreadsheet scenario setup to a question in a *Word* document click in cell **C8**. Then hit the **Alt** and **F8** keys simultaneously to show the *Run Macros* form (those are the shortcut keys to the menu choice **View > Macros > View macros**). Into the input box type **StandardNumerical** (no space between words, capitalization is irrelevant; copy & paste from above works, too). The view should look similar to below.

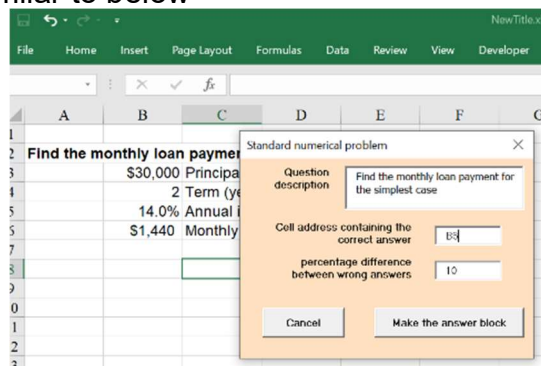


Note that in the screenshot above the **Run** button is highlighted thus confirming that the **Algogen.xla** add-in is activated. If **Run** is not highlighted then **Algogen.xla** is not activated (see the Installation Instructions step 3 for activating add-ins). Click **Run**. Read the informative form describing the **Standard Numerical macro** and click **NO** (clicking **Yes** also shows the form but does not make a new testbank).

All wizards prompt for a question description. This brief description should provide enough information about the question so that when choosing questions later from a long list of descriptions this question is recognizable.

-- Type or copy/paste this description: "Find the monthly loan payment for the simplest case".

-- Type **B6** into the input box for the cell address with the correct answer. The completed form looks similar to below



Click **Make the answer block** on the above form.

3. The form to create a new collection of algorithmic documents opens to request inputs described below.

a. Name of the collection: A code like **IntroFinance**, for example. Alternatively, use a name that describes your collection of algorithmic documents. Click **OK**.

b. Description of the Collection: Enter a glorious descriptive phrase, like **Fabulous subject**, for example. Alternatively, choose a description that otherwise works, click **OK**.

c. *Word* algorithmic document filename like **Present Value**, for example. Alternatively, use a file name that works. Click **OK**.

d. Description of this new algorithmic document, like **Analyzing annuities**, for example. Alternatively, use a document description that works. Click **OK**.

e. Two or three-letter part code: The question identification code begins with a 2 or 3 character alphabetic string followed by a number that appends to the part code automatically incrementing as new questions are added to this part of the algorithmic document. Enter **LAM**, for example. Alternatively, use a part code that works. Click **OK**.

f. Description of this part, like **Loans and amortization**, for example. Alternatively, use a part description that works for you. Click **OK**.

g. Worksheet name: The procedure renames the worksheet **AlgoMasterWS** which was active when launching the question creator wizard. Follow standard *Excel* naming practices, like **Loans**, for example. Alternatively, use your own worksheet name. Click **OK**.

Execution of the above results in creation of a directory:

C:\Users\your username\Documents\Algogen\IntroFinance
containing these three files (among others)

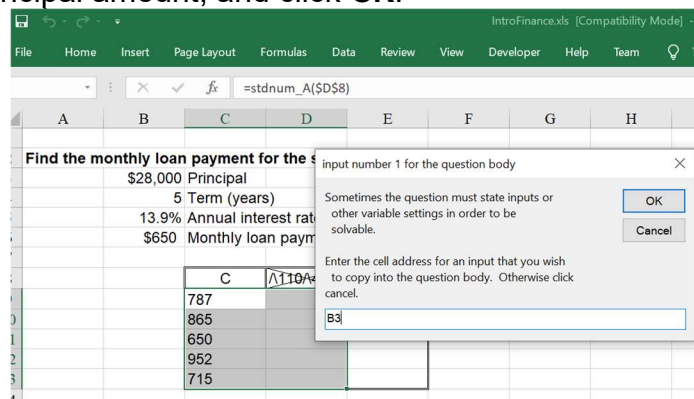
IntroFinance.xls
Present Value.doc
IntroFinance.ini

The **IntroFinance.ini** file is editable in Notepad (double-click the file to edit). The line therein that begins DOCDIR specifies the folder for saving documents made from this collection. The default folder is

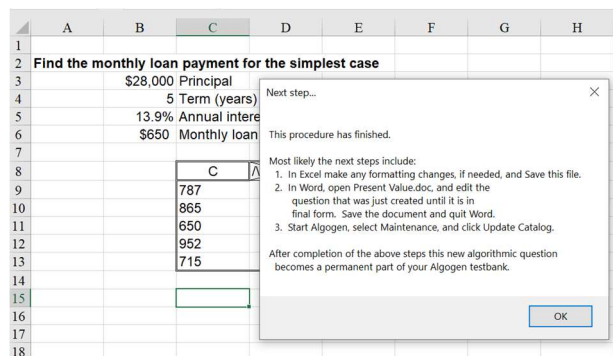
C:\Users\your username\Documents\Algogen\UserDocuments

Edit and specify any folder path that you wish, such as a course specific folder.

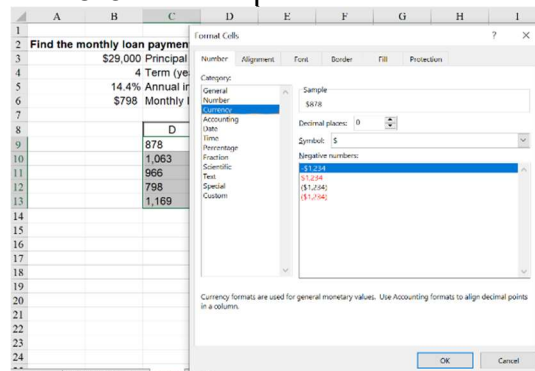
4a. The **Make the answer block** procedure asks for your patience, click **OK**. The procedure next enters the data in *Excel* and creates a *Word* document containing embedded links to the *Excel* scenario setup. Then the input box shown below prompts for any cells with content that are in the question body in the *Word* document. Type **B3**, the cell with the principal amount, and click **OK**.



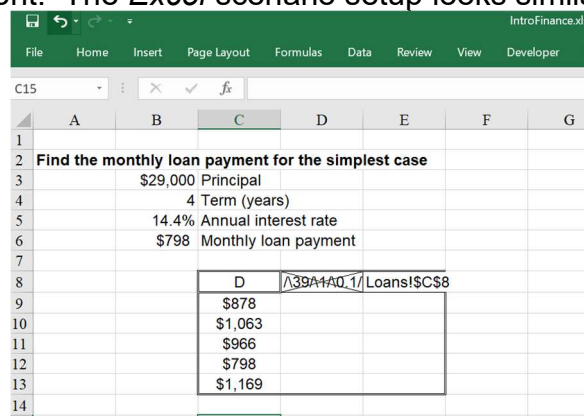
When the input box returns type **B4** and click **OK** so that the loan term can be given in the question body. Next type in **B5** and click **OK** to link the interest rate into the *Word* document. Those are the only 3 inputs required for the question body (**B6** is the answer) so click **Cancel** when the input box next returns. You'll get confirmation, shown below, that the job has finished.



Like the message above suggests, finish the question setup in *Excel*. Highlight the 5 answers in the range **C9:C13**, right click and select **Format Cells**. Like the picture below shows, select **Currency** with **zero decimal places**.



Format cells **B3** and **B6** similarly. Format **B5** as % and increase decimal places to 3, that is tenths of a percent. The *Excel* scenario setup looks similar to below.

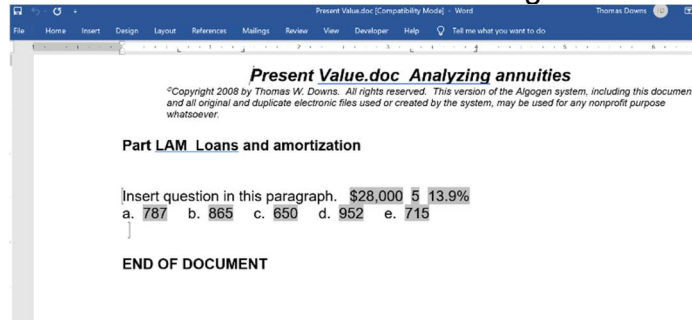


Hit the **F9** key (the shortcut key for **Formulas > Calculate Now**) and all cells recalculate as the random variables get redrawn! Hit **F9** several times and notice how it changes. Maybe the next draw looks similar to below. Notice that the answer in cell **C8** above is D whereas the answer in the version below is E. There is a $1/5^{\text{th}}$ chance that on every draw the answer lies in any one of the A-to-E locations. Also notice that the answer below of \$3,244 lies in the middle of the number range whereas the answer above of \$798 the smallest of the 5 numbers. *With these algorithms there is a $1/5^{\text{th}}$ chance that the right answer is the smallest number, the largest, or any one of the ranks in between. Contrary to popular student rules, favoring C and never choosing the largest or smallest number offers no advantage for these algorithmic questions!*

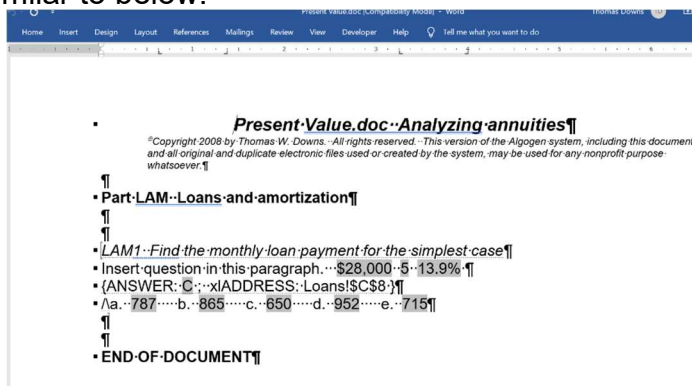
	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

The *Word* and *Excel* documents for *Algogen* use the **.xls** and **.doc** file formats, not the **.xlsx** and **.docx** formats! The new collection of algorithmic documents is in folder **C:\Users\your username\Documents\Algogen\IntroFinance**

Open the *Word* file **Present Value.doc** and see something similar to below.



Click to **Enable Editing**. The shaded fields are embedded links to the *Excel* spreadsheet. The links display the content from *Excel* in *Word*. The question body will be typed to replace the sentence “Insert question in this paragraph.” The three fields after that sentence are the inputs from *Excel* that you must drag into the question body. The line beneath the question body contains the five a-to-e answer choices. Before going further, click the **Home** tab at the top. Click the ¶ symbol. The window above refreshes to look similar to below.



The uppermost line with the question identification code **LAM1** plus the line after the question body with **ANSWER** are both formatted as hidden text. Formatting text as hidden is analogous to formatting text as, say, bold or italic. The display of hidden text on the screen is toggled by the **Tools > Options > View > Hidden** setting (clicking the ¶ symbol is the shortcut). Usually it's best to edit these documents with the hidden text showing in order to avoid errantly overtyping hidden content. Whether the hidden text prints is set separately in the *Word* **Print** Options. The hidden **ANSWER** line shows that that the question answer appears on the **Loans** worksheet in cell **C8**.

Now type the words comprising the question leaving xx where the fields will go. Usually, in fact, it is better to type the question in *Word* before starting the *Excel* setup since that forces figuring out all variables that the question will require. In any event, the view could look similar to below.

```

{L1Find the monthly loan payment for the simplest case}
Your friend respects your financial acumen and states that she is taking out a xx loan at
an annual interest rate of xx repayable monthly over xx years. She asks you how much
should she expect to pay each month. What's your answer? $28,000 5 13.9%
{ANSWER: C; ADDRESS: Loans!$C$8}
/a 787 b 865 c 650 d 952 e 715

```

Now highlight the field with the principal amount (28000 above, grab the leading space and pull across the field if that's easier) and drag it to make it read "taking out a 28000 loan". Put the loan term and interest rate numbers where they belong. Delete the xx placeholders, surplus spaces and lines. Since the *Word* question body is complete it's time to update the fields with the latest numbers from the *Excel* scenario setup. Highlight the entire *LAM1* bookmark that extends from the beginning of the identification line through the end of a-to-e choices. With the entire bookmark highlighted, hit **F9** and *Word* updates with the current cell contents from *Excel* giving a view like:

```

{L1Find the monthly loan payment for the simplest case}
Your friend respects your financial acumen and states that she is taking out a $71,000
loan at an annual interest rate of 9.0% repayable monthly over 2 years. She asks you
how much should she expect to pay each month. What's your answer?
{ANSWER: E; ADDRESS: Loans!$C$8}
/a $2,681 b $3,568 c $3,925 d $2,949 e $3,244

```

That problem is ready to use. Getting a new version is simple. Switch to *Excel*, hit **F9** to recalculate all cells, switch back to *Word* and with the question still highlighted, hit **F9**. See something like this:

```

{L1Find the monthly loan payment for the simplest case}
Your friend respects your financial acumen and states that she is taking out a $47,000
loan at an annual interest rate of 5.1% repayable monthly over 2 years. She asks you
how much should she expect to pay each month. What's your answer?
{ANSWER: A; ADDRESS: Loans!$C$8}
/a $2,064 b $1,706 c $1,876 d $1,551 e $1,410

```

For the drawing of the question above the correct answer is the largest of all five numbers. Each drawing is unique. You can highlight the question, copy it (**Ctrl c** or right-click copy), and paste it (**Ctrl v**) in any *Word* document in any folder. The copied question retains its algorithmic functionality as long as the *Excel* workbook remains at the same path. The copy can be recalculated from any folder.

4b. [Optional nonetheless relevant digression] After making a question scenario setup, especially an intricate one, it's often prudent to create more than one question about the setup. This is called a multiple question scenario setup. For this illustration let's add the following question about the setup made in step 4a: "She asks you how much will be the monthly payment and the total interest she pays over the life of the loan?" To the *Excel* workbook **IntroFinance.xls** add the following information.

-- Since labeling each *Excel* setup with the pertinent question identification code is a good idea amend the description in cell **A2** to read "**LAM1 Find the monthly loan payment and/or lifetime total interest for the simplest case**".

-- In cell **H3** type or copy/paste the label "Total lifetime payments". In cell **G3** enter the formula "**=B6*B4*12**". The formula multiplies the loan payment by the number of months in the loan term.

-- In cell **H4** enter the label "Total lifetime interest" and in cell **G4** enter the formula "**=G3-B3**". This formula finds total lifetime interest as total lifetime payments minus principal.

-- In the *Word* document **Present Value.doc** click **Insert > Bookmark**. Click on **LAM1** (if it's not already highlighted) > Click **Go to**. Every question in an algorithmic document is a *Word* named bookmark that extends from the hidden question description line through the line following the last answer. The bookmark name for the question already made, **LAM1**, is being renamed as **LAM1a**. The new question will be **LAM1b**. The two questions are substitutes, using one or the other on an assessment is reasonable, using both is nonsensical. With the bookmark **LAM1** still highlighted, click **Delete > Type LAM1a** in the **Bookmark name** box at the top of the form > Click **Add**.

-- In **IntroFinance.xls** click in cell **G8** > simultaneously hit **Alt F8** to open the **Macros** form > Type the macro name **OneCorrectPair** and click **Run** > Click **No** after reading the informative description of the One Correct Pair wizard > For the question description type or copy paste "Find monthly payment and total lifetime interest" > Enter **B6** in the Part 1 box > Enter **G4** in the Part 2 box. The completed form should look like:

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I
1									
2		LAM1 Find the monthly loan payment and/or lifetime total interest for the simplest case							
3		\$47,000	Principal				\$49,537	Total lifetime payments	
4		2	Term (years)				\$2,537	Total lifetime interest	
5		5.1%	Annual interest rate						
6		\$2,064	Monthly loan payment						
7									
8		A	/22A+017/01						
9		\$2,064							
10		\$1,706							
11		\$1,876							
12		\$1,551							
13		\$1,410							
14									
15									
16									
17									
18									
19									

The 'Find the proper pair' dialog box is open, showing the following fields:

- Question description: Find monthly payment and total lifetime interest
- part 1: B6
- part 2: G4
- part 1: Address of a cell with Number
- part 2: Address of a cell with Number

Buttons: Cancel, Make the answer block

Click **Make the answer block** on the above form. The Developers backdoor form for growing the testbank opens. The left panel populates with all *Word* documents contained in this algorithmic document collection, only one so far. Click on **Present Value** in the left panel and click the **Next** button above the panel. The right panel populates with all the bookmarks in the document. Thus far, there is only one bookmark. Click on **LAM1a** in the right panel. The view is similar to below.

The screenshot shows the same Excel spreadsheet as above. The 'Grow the masterfiles on this computer for IntroFinance.xls' dialog box is open, showing the following fields:

- 1. Choose document below for receiving new question and click "Next": Present Value
- 2. Check boxes (if any) that apply to the new question:
 - begin a multiple question setup: ☐
 - begin new part in selected document: ☐
 - add new document to testbank: ☐
- 3. Choose code after which new question will be inserted and click "Finish": LAM1a

Buttons: 1. Next, 2. Finish, Abort creating question

Usually a multiple question scenario setup is made by checking the box at the center top of the above form instead of renaming a bookmark. When launching a new collection like in step 4a, however, the above form doesn't open. Hence, the unusual task of renaming **LAM1** to **LAM1a** was needed. Click **Finish** on the above form. Next, a form opens asking whether the new question belongs to the same *Excel* setup as **LAM1a**, click **Yes** to that > Click **Yes** that you are good to go > Click **OK** that you'll be

patient > When the query to input a cell address pops up click **Cancel** since **LAM1b** uses the same input variables that **LAM1a** already includes > Click **OK** to confirm the job finished.

-- With the hidden text showing then **Present Value.doc** looks similar to below.

```

• Present Value.doc--Analyzing annuities¶
  Copyright ©2020 by Thomas W. Downs. All rights reserved. Usage of the Allogos system, including all printed
  documents and all original or duplicate electronic files used or created by the system, are subject to restrictions in the
  End-User License Agreement at the end of the Allogos Help Document. This software may be used for any non-profit
  purpose whatsoever. For-profit use requires approval in advance from td@elementsoffinance.net¶

¶
• Part LAM--Loans and amortization¶
  ¶
  ¶
  • LAM1--Find the monthly loan payment for the simplest case¶
  • Your friend respects your financial acumen and states that she is taking out a $47,000
  loan at an annual interest rate of 5.1% repayable monthly over 2 years. She asks you
  how much should she expect to pay each month. What's your answer?¶
  • {ANSWER: A:::xlADDRESS:Loans!$C$8}¶
  • Aa. $2,064 b. $1,706 c. $1,876 d. $1,551 e. $1,410¶
  ¶
  • LAM1b--Find monthly payment and total lifetime interest¶
  • Insert question in this paragraph. ¶
  • {ANSWER: B:::xlADDRESS:Loans!$G$8}¶
  • Aa. 245 5,386¶
  • Ab. 185 6,194¶
  • Ac. 245 6,194¶
  • Ad. 213 6,194¶
  • Ae. 213 5,386¶
  ¶
  ¶

```

Make the following changes to the above document:

-- Type "a" after the description **LAM1** so that it reads **LAM1a**.

-- Highlight the first sentence in the question body of **LAM1a** and click and drag while holding the **Ctrl** key so as to copy this sentence with the loan input variables at the beginning of the question body for **LAM1b**. The links copy and paste that easily!

-- In **LAM1b** replace "Insert question in this paragraph. " with the new question: "She asks you how much will be the monthly payment and the total interest she pays over the life of the loan?"

-- Into each answer type or copy/paste phrases such that each answer states: "The monthly payment is" [field 1] "and the total lifetime interest is" [field 2].

-- Switch to the *Excel* workbook **IntroFinance.xls** and format the answer block for **LAM1b** as Currency with zero decimal places.

-- Type brief question descriptions into cells **C7** and **G7** for **LAM1a** and **LAM1b**, respectively.

-- Hit **F9** to recalculate **IntroFinance.xls**. Highlight the two questions in **Present Value.doc** and hit **F9** to draw another view of the questions. The files should look similar to the screenshots below.

The screenshot shows the 'IntroFinance.xls' workbook with the following data:

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											

Detailed description of the screenshot: The Excel workbook 'IntroFinance.xls' is open. The 'LAM1a' section (rows 2-7) contains input variables: Principal (\$16,000), Term (5 years), Annual interest rate (4.5%), and Monthly loan payment (\$298). The 'LAM1b' section (rows 8-13) contains calculated values: Monthly payment (\$394), Total lifetime payments (\$2,182), and Total lifetime interest (\$343). The formulas for LAM1b are shown in the adjacent column: =(\$16000)/(\$298*12) for the monthly payment and =(\$394*12) for the total lifetime payments.

• **Present-Value.doc--Analyzing annuities¶**
Copyright ©2000 by Thomas W. Dowd. All rights reserved. Usage of the Algogen system, including all printed documents and all original or duplicate electronic files used or created by the system, are subject to restrictions in the End User License Agreement at the end of the Algogen Help document. This software may be used for any non-profit purpose whatsoever. For profit use requires approval in advance from td@elementsoffinance.net.¶

¶
•Part LAM- Loans and amortization¶
 ¶
 ¶
•LAM1a: Find the monthly loan payment for the simplest case¶
 • Your friend respects your financial acumen and states that she is taking out a **\$16,000** loan at an annual interest rate of **4.5%** repayable monthly over **5** years. She asks you how much should she expect to pay each month. What's your answer?¶
 • (ANSWER: **C** ; :x:ADDRESS: Loans\$C\$8)¶
 • /a. **\$271** --- b. **\$224** --- c. **\$288** --- d. **\$204** --- e. **\$247**¶
 ¶
•LAM1b: Find monthly payment and total lifetime interest¶
 • Your friend respects your financial acumen and states that she is taking out a **\$16,000** loan at an annual interest rate of **4.5%** repayable monthly over **5** years. She asks you how much will be the monthly payment and the total interest she pays over the life of the loan?¶
 • (ANSWER: **D** ; :x:ADDRESS: Loans\$G\$8)¶
 • /a. The monthly payment is **\$394** and the total lifetime interest is **\$2,182**.¶
 • /b. The monthly payment is **\$298** and the total lifetime interest is **\$2,182**.¶
 • /c. The monthly payment is **\$343** and the total lifetime interest is **\$1,897**.¶
 • /d. The monthly payment is **\$298** and the total lifetime interest is **\$1,897**.¶
 • /e. The monthly payment is **\$343** and the total lifetime interest is **\$2,182**.¶
 ¶

5. After finishing your question making session then register the questions for use in *Algogen*. Save and close all open *Word* and *Excel* files. Start *Algogen*, click **Maintenance** > click **Check testbank settings**, click on the new testbank description, click **Save changes** > click **Maintenance** > click **Add new questions** > checkmark **Update all files** > click **Update Now**. Later you might add more questions from your content to this **IntroFinance** algorithmic document, or maybe you'll make another entirely new collection and delete this "practice" one (delete its entry in **Algogen.ini** with Notepad, too). Likely you have many old exam questions that can convert into an algorithmic format. That's it! Keep adding questions!