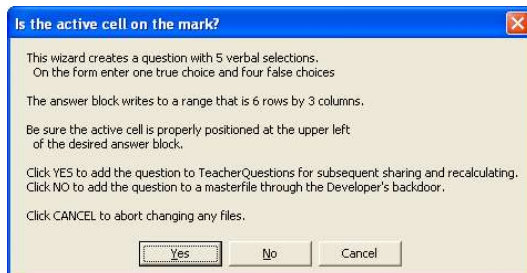


Algorithms that package content into question scenario setups

v2020.0825 by Tom Downs

An algorithmic document delivers an endless stream of the same question scenario setup, each draw offering unique views of random numbers, modifiers, words, any content that populates a choice set. Upon launching an *Excel* question creator wizard see a prompt similar to this.



The first paragraph briefly describes the type of question that this wizard is creating. The second paragraph states the size of the answer block. The third paragraph is a reminder to be sure that in *Excel* the active cell is at the upper left of the desired answer block. Existing cell contents in the answer block will be overwritten so make sure they are empty or nonessential.

Click **YES** if the objective is to add the question to **StructureDownsTQ.doc** (or to **titleTQ.doc** if this *Testbank Well* has a different title). This allows an end-user besides the testbank developer to collect together in one document all the questions that she or he may create. If/when this end-user updates the *Testbank Well* with a new edition from the title developer, the TQ document is not overwritten even though the other algorithmic documents and workbook file for the title may be replaced. Thus, the developer should leave alone the **titleTQ.doc** file and add new question scenario setups to other documents in the *Testbank Well*, i.e, Developers just click **NO**.

Click **NO** if the objective is to add the question to one of the other algorithmic documents in the *Testbank Well*. These other documents pertain to specific chapters or sections in the book. The wizard later prompts for which document to open and where to place the question. Usually, however, the developer finds it more efficient with these steps:

- (1) Start *Word* and open the existing document pertinent to the topic of the new question. Choose the target location in the document for the new question. Type the new question and make sure you are not within another question's boundaries (click **Tools** > **Options** > **View** > click **Bookmarks** > **OK**; the square brackets [] delineate question bookmarks). Make the question phrasing correct and leave a few blank spaces wherever you'll want to insert a variable from *Excel*. Remember that variables might include a number, a choice of verbs (e.g., rises or falls), a choice of a modifier (e.g., smaller or larger), a choice of nouns (dollars or Euros), etc.
- (2) Start *Excel* and make the question setup, if any. When the setup is ready then position the active cell, hit the **Alt** and **F8** keys simultaneously to show the *Run Macros* form, type the macro name for the desired wizard, and click **Run**. Click **No** to add the question to the *Testbank Well* through the Developer's backdoor for the active **title**. Select the document and the question code preceding your target location, and **Finish**.

HINT: *Excel* uses the ampersand (&) as a concatenation operator. This little-known yet powerful feature enables incredible flexibility constructing statements. For example, enter into a blank worksheet the following:

in A1 enter: =CHOOSE(RANDBETWEEN(1,2),"my car costs","my house costs")

in A2 enter: =10000*RANDBETWEEN(1,10)

in A3 enter: = A1 & A2

After entering the three cells hit the **F9** key repeatedly to recalculate the cells. See algorithmic draws that include "my car costs 30,000", "my house costs 90,000", etc. There are many opportunities to use the ampersand to combine inputs from different cells when making true or false statements. See the various question setups in **StructureDowns.xls** for examples.

(3) When the wizard is done switch back to the existing *Word* document. Cut and paste or highlight and drag the question phrasing you made into the boundaries made by the wizard. Click and drag the embedded links for the question body into the blank spaces. If one of those variables appears twice then click and drag while holding Ctrl to drag a copy.

With the procedures above you easily add new questions in minutes. When you have finished your session for adding questions, quit *Word* and *Excel*. Start *Algogen*. Click **Maintenance > Add questions to catalog > select All Files > Update**. They now are ready for exam and handout documents.

Find below information about the Developer's backdoor form populated by data from the *Testbank Well* that accompanies the *Elements of Finance* book.

Developer's backdoor for StructureDowns.xls

1. Choose document below for receiving new question and click "Next"

2. Check boxes (if any) that apply to the new question

3. Choose code after which new question will be inserted and click "Finish"

1. Next

2. Finish

Backdrop
FinAct
Growth
CashFlows
PVFV
Annuities
CapB
BondV
StockVal
Port
RiskMgt1
RiskMgt2
InterN

begin a multiple question setup ☐

begin new part in selected document ☐

add new document to testbank ☐

Cancel

CB1
CB10
CB11
CB2a
CB2b
CB2c
CB3am
CB3bm
CB3cm
CB3dm
CB3em
CB4
CB5

The form has two list-boxes. The left one lists names of all documents in the testbank library (except the TQ document). To add a new question to an existing document click on its name in the left list-box and click **Next**. The right list-box shows the code for each question in the selected document. The new question is inserted into the selected document immediately after the selected question code. To add a new question to the end of the document simply select the last item in the list and click **Finish** (the biggest code number may often be the last question in the document unless some questions have been inserted somewhere in the middle).

For most instances none of the checkboxes in the middle of the form need checked. The discussion below explains the checkboxes.

Multiple question setups occur when several questions are dependent on the same information. Check the box to begin a **multiple setup**, choose the code after which the new question is to be inserted, and click **Finish**. Prompts ask you which type of multiple

setup you want to begin, and the wizard automatically completes all tasks. There are two types of multiple question setups.

- (1) Multipart single-setup questions have a common scenario setup that contains information relevant to several dependent questions. When one or more multipart single-setup questions are put on an exam the common question body is copied once, and then each selected question is copied. These questions tend to be complements that follow-up the setup with several questions. Question codes for multipart single-setup questions always end with the letter **m**. For an example of this type setup, see `C:\Users\your username\Documents\Algogen\NewTitle\DemoQuestions.doc` questions **FN1am**, **FN1bm**, and **FN1cm**.
- (2) Overlapping parts questions seem separate and independent because there is no common question body. But they are not independent because all overlapping-parts questions link to the same worksheet setup. Sometimes one part may contain the answer to another part's question, or two parts may ask the same question in a different way. Overlapping-parts questions tend to be substitutes so asking both on one document may be nonsensical. Question codes for overlapping parts questions always have the same prefix so that the end-user is aware the questions rely on the same *Excel* setup. For example, see `C:\Users\your username\Documents\Algogen\StructureDowns\DemoQuestions.doc`, questions **PS1a**, **PS1b**, and **PS1c**.

An algorithmic document in a *Testbank Well* may contain several parts just like a chapter has several sections. To add a new part at the end of the selected document check the box **Begin new part in selected document** and click **Finish**. You will be prompted for a new part code and part description.

An algorithmic testbank document may contain several dozen questions pertinent to a particular chapter or broad topic. Questions belong to different parts in the document. Because documents get big quickly, perhaps the finished testbank will include a dozen or more documents. Begin a new document by checking the box **Add new document to testbank** and click **Finish**. The wizards do everything automatically so that all you have to do is supply knowledge about your subject!

Algogen offers the 8 unique question creator algorithms shown in the table below.

Wizard name & Macro name	Description
1. Standard Numerical <i>Macro name:</i> StandardNumerical	Give one correct number. Four decoys are randomly created. Five numbers appear as A-to-E choices.
2. Standard Verbal <i>Macro name:</i> StandardVerbal	Give five pairs of statements, each with one true statement and one false statement. One of the true statements will be randomly chosen to display in one of the A-to-E locations. The other locations will show the four false statements.
3. Three Correct Pairs <i>Macro name:</i> ThreeCorrectPairs	Give three pairs of inputs in which each of the two members in each pair correspond correctly to each other. One of the five pairs is correctly matched in an

	A-to-E location and the other choices mix the members from the non-corresponding pairs.
4. Recombine One Pair <i>Macro name:</i> OneCorrectPair	Give one pair of inputs in which the two members in each pair correspond correctly to each other. The correct pair displays in one of the A-to-E locations. The four wrong answers contain one correct part matched with a decoy that makes the answer false.
5. Complex Verbal <i>Macro name:</i> ComplexVerbal	Give three pairs of statements, each with one true statement and one false statement. A statement from each pair appears in locations A, B, and C. Location D says that two of the above are correct. Location E says that either all are correct or none are correct.
6. True-False <i>Macro name:</i> StandardTrueFalse	Give one pair of statements, one true statement and one false statement. One of them is randomly chosen to display. The question ask whether that one is true or false.
7. Simplistic verbal <i>Macro name:</i> SimplisticVerbal	Give five statements, one true and four false. The five statements randomly rearrange throughout the A-to-E locations.
8. Three choices <i>Macro name:</i> Threechoice	Give three statements, one true and two false. The three statements randomly rearrange throughout the A-to-C locations. You can add non-random choices to locations D and E later.

All wizards prompt for cell addresses to copy into the question scenario setup. The question might require providing the student, for example, an interest rate or velocity or some other number, phrase, or element from a choice set. Before launching the wizard, make sure that each required input exists in a worksheet cell. The wizard will prompt for the cell address then copy the content with an embedded link pasted into the *Word* scenario setup.

The answer block that the wizard writes in *Excel* encompasses a range that is 6 rows by 3-or-more columns. Any existing contents in the answer block will be overwritten. The cell that is active prior to launching the wizard becomes the upper left corner of the answer block. Before launching any wizard, therefore, be sure to position the cursor on a cell that will become the upper left corner of the answer block. Start the answer block, say, two rows beneath the last row containing variables (i.e., cells) for the scenario setup.

The *Algogen* system has four sets of intrinsic random variables that often are useful when constructing the question setup in the *Excel* worksheet. These named variables can be used in a standard formula. They are described below.

sign1 – This intrinsic random variable has an even probability (50%) of equaling either +1 or -1. This may be useful for making a secondary variable that deviates either above or below a primary variable. Consider this illustration. Suppose the primary variable for a question is an interest rate that is set in cell **B10**, as “=**randbetween(350,950)/10000**”. The **randbetween(a,b)** function resides in the Analysis ToolPak and returns an integer from the range **a** to **b** (inclusive, **a < b**) with

a uniform probability. Thus, the function above returns one integer from 350 to 950 (601 possible values). The formula then divides the integer by 10,000. The result is a primary interest rate in this question that could equal 3.50%, 3.51%, ..., 5.21%, 5.22%, ..., 9.49%, or 9.50%. Suppose the question learning objective involves a secondary interest rate set in cell **B11** with the formula “= **B10** + **sign1***2%”. The secondary rate is set to equal the primary rate plus 2% (@50% chance) or minus 2% (@50% chance). That is, if the primary rate is 7.37% then the secondary rate has 50% chance of equaling 5.37% and a 50% chance of equaling 9.37%. The independent random variables **sign2**, ..., **sign5** are analogous to **sign1**. Each is either +1 or -1 with a 50-50 chance. For example, if cell **B12** sets a primary variable as “=randbetween(25,75)*10” then the range for the variable is from 250, 260, 270, ..., 740, 750. If a secondary variable is set in **B13** as “=B12 + **sign2***25” then this variable always is either 25 less or 25 more than the primary variable. Sometimes **sign1** and **sign2** might both be positive, but not always, it depends on the luck of the draw! For a given recalculation of the workbook, however, **sign1** has the same value in all question setups that use the variable. This introduces a dependence between those questions that could be problematic. The cell that sets **sign1**, say **B8**, contains the formula “=IF(randbetween(0,1)=0,1,-1)”. When **randbetween** returns zero then cell **B8**, which is named **sign1**, is set equal to 1. When **randbetween** returns 1 then **sign1** is set equal to -1. Eliminate the dependence between different questions using **sign1** by putting into each question scenario a formula like shown for **B8**. All secondary variables would reference this question specific formula instead of referencing the common variable **sign1**.

flag1 – This intrinsic random variable has an even probability (50%) of equaling either 0 or +1. This may be useful when setting a random variable that chooses one of two choices. For example, suppose that a question asks either “How much is the price-to-book ratio?” or “How much is the price-to-earnings ratio?” Different views of this question display one statement or the other with a 50-50 probability. The *Excel* cell that asks the question, say **B15**, contains the formula “=if(flag1=0, “price-to-book”, “price-to-earnings”)”. The cell displays price-to-book when **flag1** equals 0. Otherwise, it displays price-to-earnings. The *Word* document with the question scenario setup has the sentence “How much is the {link displaying contents of cell **B15**} ratio?” The question creator wizard automates in *Word* the insertion of field links to *Excel*. The independent random variables **flag2**, ..., **flag5** are analogous to **flag1**. There is a dependence between all the different question scenario setups that reference the same common intrinsic variable that might be problematic (because students sometimes might get clues about one question by something that happens in a different question).

mask10 – This intrinsic random variable has an even probability (50%) of equaling either 1.10 or 0.9091 (i.e., 1/1.10). This may be useful when setting a secondary variable to either 10% greater or 10% less than a primary variable. For example, suppose that a question sets a price in cell **B16** as “=randbetween(5,20)*5”. That is, the price might equal \$25, \$30, \$35, ..., \$95, \$100. A secondary variable might be the price of a different asset that is set in cell **B17** as “=B16*mask10”. Thus, **B17** is either 10% greater than **B16** or 10% smaller. Analogous independent random variables are set at 20% (i.e., **mask20** =IF(randbetween(0,1)=0,1.2,1/1.2) , 30%, 40%, ... , 90%, 100%, and 200% (i.e., **mask200** =IF(randbetween(0,1)=0,3,1/3).

vmask10 – This intrinsic random variable works like **mask10** described above but variability around 10% exists. That is, **vmask10** ranges from 8% to 13% greater or smaller than unity. The cell that sets the named variable **vmask10** contains “=(1+randbetween(8,13)/100)^(IF(randbetween(0,1)=0,1,-1))” Likewise analogous independent random variables are set at 20% (i.e., **vmask20** = (1+randbetween(18,25)/100)^(IF(randbetween(0,1)=0,1,-1))), 30% (i.e., **vmask30** = (1+randbetween(26,35)/100)^(IF(randbetween(0,1)=0,1,-1))), etc.

Launch any of the 8 wizards by hitting the **Alt F8** keys when ready, typing the macro name, and clicking **Run**.

Algorithm 1. The Standard Numerical Wizard
Macro-name = StandardNumerical

The Standard Numerical wizard presents five numbers as choices A-to-E. The algorithm randomizes in two dimensions: by location (1/5th chance in choice A, ..., 1/5th chance in choice E) and by rank (1/5th chance the smallest choice, ..., 1/5th chance the biggest choice). The following question illustrates a standard numerical problem that might be in a *Word* document for a finance testbank.

How much is the payment for a loan of \$179,000 with an annual interest rate of 9.60% (compounded monthly) repayable over 20 years with payments due monthly?
a. \$1,400 b. \$1,680 c. \$2,903 d. \$2,016 e. \$2,420

The answer to the above problem is \$1,680. The selection actually contains the answer and other information formatted as hidden text. The *Word* user setting toggles whether hidden text displays or prints. The same selection with hidden text visible shows:

TQ1 Find loan payment given varying (principal, term, rate, payment frequency)
How much is the payment for a loan of \$179,000 with an annual interest rate of 9.60% (compounded monthly) repayable over 20 years with payments due monthly?
{ANSWER: B ; xIADDRESS: TeacherQuestions!\$B\$17 }
{ATOE}a. \$1,400 b. \$1,680 c. \$2,903 d. \$2,016 e. \$2,420

The shaded words and numbers in the above question are field links to cells in the *Excel* spreadsheet (usually the shading is not printed). The cells contain formulas that rely on random variables. The question consequently assumes an infinite number of numerical appearances. The preceding problem, for example, recalculates as:

How much is the payment for a loan of \$108,000 with an annual interest rate of 8.10% (compounded annually) repayable over 25 years with payments due annually?
{ANSWER: A ; xIADDRESS: TeacherQuestions!\$B\$17 }
{ATOE}a. \$10,204 b. \$12,245 c. \$8,503 d. \$7,086 e. \$14,694

Recalculation assigns new values to the loan amount, the interest rate, the loan term, and payment frequency. Answers automatically recompute and reposition. One time the problem might specify monthly payments but the next time payment frequency might be quarterly, semiannually, or annually.

The discussion below explains how to use the Standard Numerical wizard to add the preceding question to **StructureDownsTQ.doc**. The reader may copy the statements from this help guide and paste them into *Word* and *Excel*, as appropriate, to serve as a tutorial.

Start *Word* and open **StructureDownsTQ.doc**. Move to the blank space preceding the last paragraph that states “END OF DOCUMENT”. Type a rough draft of the question leaving two spaces wherever a shaded field appears. Type or copy:

How much is the payment for a loan of _____ with an annual interest rate of _____
(compounded _____) repayable over _____ years with payments due _____ ?

Save StructureDownsTQ.doc

Open the *Excel* workbook accompanying *Algogen*. Activate the worksheet named “TeacherQuestions” by clicking on its bottom tab. Scroll past the last question on this worksheet, leaving about 4 blank rows to serve as a neutral zone between the old and new questions.

Suppose, for example, that the worksheet is empty and the new question starts in cell A6. In cell A6 type a brief description of the setup. For example, click on cell A6 and type or copy “Find loan payment given varying (principal, term, rate, payment frequency)” and hit the enter key.

Click on cell B8 and type “Principal” and hit the enter key.

Click on cell A8 and type or copy “=randbetween(4,12)*25000” and hit the enter key.

The *Excel* help library explains that “randbetween” is a function from the Analysis-ToolPak add-in that randomly chooses an integer between the two numbers in parentheses. Every recalculation of the worksheet returns a new value for randbetween. For cell A8 a random number between 4 and 12 is multiplied by 25,000. The loan problem therefore specifies in cell A8 a principal amount that might vary from as little as \$100,000 to as much as \$300,000. Always, too, the principal will be a multiple of \$25,000. For example, \$250,000 and \$275,000 are possible principal amounts, but not \$260,000. To modify the problem so that the principal is a multiple of \$10,000 the proper formula is “=randbetween(10,30)*10000”

Excel functions such as “randbetween”, “choose”, and “index”, as well as many others, provide the question designer with substantial creative flexibility.

If cell A8 returns the error **#NAME** then the **Analysis-ToolPak** add-in is disabled. Click on Tools, Add-ins, and checkmark **Analysis-ToolPak**. If **Analysis-ToolPak** is not a choice, then it does not reside on your hard disk. Exit *Excel*, use the original *Microsoft Office* software installer to add this particular add-in. Do a Google search for more information about add-ins.

In cell B9 enter “Loan term in years” and in cell A9 type or copy “=randbetween(3,7)*5”
The formula in cell A9 sets the loan term to multiples of 5 between 15 years and 35 years.

In cell B10 enter “Interest rate per annum” and in cell A10 type or copy “=randbetween(65,105)/1000” The formula in cell A10 sets the loan interest rate to multiples of 0.10% between 6.5 percent and 10.5 percent.

In cell B11 enter “Payment index” and in cell A11 type or copy “=randbetween(1,4)”

In cell B12 enter "Payment frequency, adjective" and in cell A12 enter
=choose(A11,"monthly","quarterly","semiannually","annually")

[*Aside* For reasons only Microsoft knows, quotes don't always copy from *Word* to *Excel* so the formula in cell A12 may need to be typed, not copied]. In cell B13 enter "Payments per year" and in cell A13 type or copy "=choose(A11,12,4,2,1)"

Cell A11 equals one of the numbers: 1, 2, 3, or 4. Cell A12 returns one of the words "monthly", "quarterly", "semiannually", or "annually". The exact word chosen by the spreadsheet depends on the value in cell A11: "monthly" is chosen if A11 equals 1, "quarterly" is chosen if A11 equals 2, etc. Cell A13 returns the payments per year in an analogous way. The *Excel* help library explains the precise usage of the "choose" function. Different calculations of the spreadsheet return different payment frequencies.

In cell B14 enter "Payment amount" And in cell A14 enter
=PMT(A10/A13,A9*A13,-A8)

Excel documentation explains that the PMT function computes a loan payment given the periodic interest rate (A10/A13), the total number of payments throughout the loan life (A9*A13), and the loan amount (A8, entered with a negative sign so that the payment is a positive number).

Complete the setup by formatting the worksheet cells to show percentages with a % sign and two decimal places, dollars without cents, etc. Recalculate the spreadsheet a few times by hitting the **F9** key (recalculation also is done by clicking **Tools, Options, Calculation, Calculate Now**, but hitting **F9** is easier). Observe the diverse appearances that this simple problem assumes.

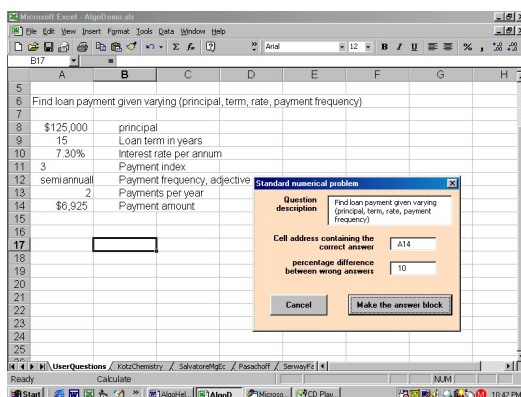
The setup is complete and now is time to run the question creator wizard. Switch to *Excel* and click on cell B17. This becomes the upper left corner of the answer block. To launch the wizard, run the macro **StandardNumerical**. The wizard presents an introductory message box. Click **YES** after reading the message box (click **NO** to add the question to one of the other *Word* documents besides **titleTQ.doc** or if you launch a new *Testbank Well*).

Enter an adequate question description, such as

Find loan payment given varying (principal, term, rate, payment frequency)

Tab to the field requesting the address of the answer, and enter A14

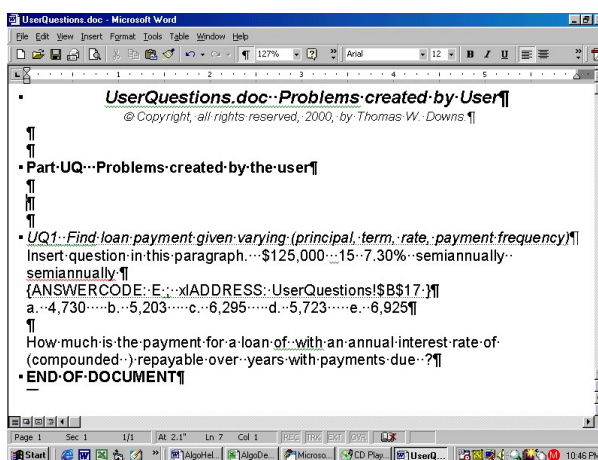
The form field requesting a "percentage difference between wrong answers" is set automatically to 10 percent. For large answers, such as a loan payment, this number may be set to ten or even smaller. For small answers, such as a question in which the answer might be say 0.0025 British Thermal Units, the setting might be increased to say fifteen or twenty-five if student rounding errors become a concern. A setting of 100 forces answers to equal whole numbers that differ by exactly one unit, like 7, 8, 9, 10, and 11. The completed form and worksheet look like below.



Click **Make the answer block**. The wizard prompts for fields that belong in the question body. For this loan payment problem there are four different variables in the question body: the principal from cell A8, the term from A9, interest rate from A10, and the payment frequency from A12 (the A12 link appears twice in the question body). Enter one cell address at a time, click **OK**, and enter the next address until all five have been entered. Click **Cancel** when all question body links have been referenced.

When the wizard finishes there are five answers in B18:B22 that link to the *Word* document as selections A-to-E, respectively. The correct numerical answer appears in the location identified by the letter answer in cell B17. Hit **F9** to recalculate the worksheet and notice that the input parameters change, the numerical answer changes, the letter answer changes, and the rank of the correct number relative to the four wrong numbers changes.

Inspect the *Word* file **StructureDownsTQ.doc**. Some characters possess hidden formatting. To see them, click **Tools, Options, View, All**. The problem appears similar to the window below.



Highlight the text in the sentence “How much is ... due ?”, cut and paste it over the text “Insert question in this paragraph.” Then click and drag into the proper location the fields showing the inputs for principal, term, rate, and payment frequency (“semiannually” appears twice in the question body; If there are not two fields to click and drag simply copy and paste as if a regular word – the links easily copy like any other word!).

Finally, verify the integrity of the question. Highlight the entire question. Hit **F9** to ascertain that all fields update properly. Save and close **StructureDownsTQ.doc** and the *Excel* workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting **Maintenance, Update Catalog**. The question is now a permanent member of your personalized *Algogen Testbank Well*.

Algorithm 2. The Standard Verbal Wizard
Macro-name = StandardVerbal

The Standard Verbal wizard presents five phrases or sentences in choices A-to-E. Underlying each choice is a pair of selections, one true and the other false. This setup actually contains, therefore, five true statements and five false statements. One true statement is randomly chosen and randomly placed in locations A-to-E. The illustration below is a standard verbal question that might appear in an introductory geography testbank.

Which of the following statements most accurately describes geographical attributes of the United States?

- a. the largest state is Texas at 266,807 square miles
- b. Mount McKinley in Alaska has the highest altitude at 20,230 feet
- c. the lowest point is the bottom of the Grand Canyon at -282 feet
- d. the state in the lower 48 with the longest coastline is Florida
- e. the longest river system is the Mississippi – Ohio at 3,710 miles

The shaded sentences in the above question are fields that link to cells in the *Excel* spreadsheet. The cells rely on random variables. The question, consequently, may assume many appearances. The discussion below explains how to use the Standard Verbal wizard to add the preceding question to **titleTQ.doc**. The developer may copy the statements from these instructions and paste them into *Word* and *Excel*, as appropriate, to serve as a tutorial.

Start *Word* and open **StructureDownsTQ.doc**. Move to the blank space preceding the last paragraph that states “END OF DOCUMENT”. Type or copy a rough draft of the question body:

Which of the following statements most accurately describes geographical attributes of the United States?

For this simplistic question there are no links in the question body. Save and close **StructureDownsTQ.doc**

Open the *Excel* workbook **StructureDowns.xls** that downloads with *Algogen*. Activate the worksheet named **TeacherQuestions** by clicking on its bottom tab. Scroll past the last question on this worksheet, leaving about 4 blank rows to serve as a neutral zone between the old question the new one. Suppose, for example, that we wish to start the question in cell A26. In cell A26 type a brief description of the question. For example, click on cell A26 and type or copy

Geographical attributes of the United States

The *Excel* setup is minimal because the Standard Verbal wizard prompts for all necessary information.

Click on cell B29. This becomes the upper left corner of the answer block. To launch the wizard, run the macro **StandardVerbal**. The wizard presents an introductory message box. Click **YES** after reading the message box (click **NO** to launch a new add the question to one of the other *Word* documents besides **titleTQ.doc**).

Enter an adequate question description, such as

Geographical attributes of the United States

The form offers five pairs of blanks. One blank in each pair is for a true statement and the other is for a false statement.

Type or copy the following statements into the form:

pair A true:

the largest state is Alaska at 591,004 square miles

pair A false:

the largest state is Texas at 266,807 square miles

pair B true:

Mount McKinley in Alaska has the highest altitude at 20,230 feet

pair B false:

Mount Whitney in California has the highest altitude at 14,494 feet

pair C true:

the lowest point is the bottom of Death Valley at –282 feet

pair C false:

the lowest point is the bottom of the Grand Canyon at –282 feet

pair D true:

the state in the lower 48 with the longest coastline is California

pair D false:

the state in the lower 48 with the longest coastline is Florida

pair E true:

the longest river system is the Mississippi – Missouri at 3,710 miles

pair E false:

the longest river system is the Mississippi – Ohio at 2,320 miles

The small checkboxes on the form to the left of the statement fields are useful when you need to enter a cell address instead of a statement. You need to enter a cell address when either of two situations occur:

(1) A long statement should be typed into its own cell. With the illustration above, even though no statement is too long, you could put the statement for choice E-true into cell B28. That is, in cell B28 type (or paste) “the longest river system is the Mississippi – Missouri at 3,710 miles”. Then on the form for E-true type B28 and check the box.

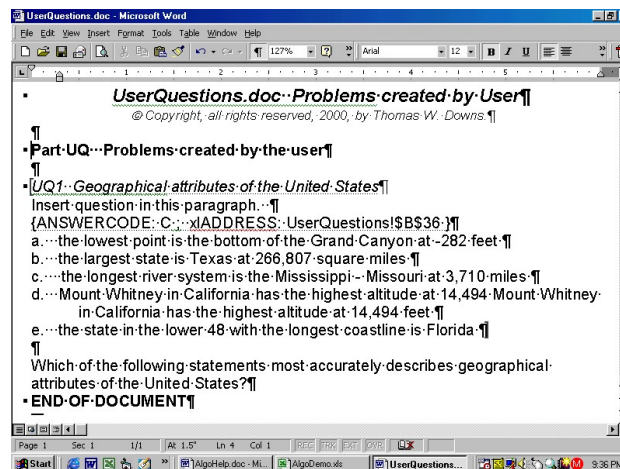
(2) Immense flexibility exists by making statements that are conditional on various conditions. Suppose that D-true were to list either of two correct statements. Put in cell B27 both true statements, as follows:

=CHOOSE(RANDBETWEEN(1,2),”the state in the lower 48 with the longest coastline is California”,”the U.S. state with the longest coastline is Alaska”)

The Excel function $\text{CHOOSE}(n, x_1, x_2, \dots, x_n)$ returns the n 'th element of the list x_1, x_2, \dots, x_n . The statement in cell B27 randomly chooses between statement 1 about California, or statement 2 about Alaska.

Now launch the **StandardVerbal** macro, click **Yes** to add this to the TQ document, and click **"Make the answer block"**. The wizard eventually prompts for inputs to insert into the question body. There are none for this question, so respond to this query by clicking Cancel. When the wizard finishes there are five choices in the range B30:B34 that correspond to the five A-to-E choices in the *Word* document. One choice, randomly selected, is correct and four are wrong. The letter answer in B29 identifies the correct answer. Recalculate the spreadsheet a few times by hitting the **F9** key (recalculation also is done by clicking **Tools, Options, Calculation, Calculate Now**, but hitting **F9** is easier). Observe the many appearances that this simple problem assumes.

Inspect the *Word* file **StructureDownsTQ.doc**. Some characters possess hidden formatting. To see them, click **Tools, Options, View, All**. The problem appears similar to the window below



Highlight the text “Which of the .. United States?”, cut the text, and paste it over the phrase “Insert question in this paragraph. “

Finally, verify the integrity of the question. Highlight the entire question, and hit **F9** to ascertain that all fields update properly. Save and close **StructureDownsTQ.doc** and the *Excel* workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting **Maintenance, Update Catalog**. The question is now a permanent member of your personalized *Algogen* testbank.

Algorithm 3. The Complex Verbal Wizard Macro-name = ComplexVerbal

The Complex Verbal wizard prompts for three pairs of statements. Each pair contains one true and one false statement. One statement from each pair appears in answers A, B, and C, respectively. Choice D says that two of the statements are correct, and choice E says that either all or none are correct.

Illustration 1 The first of two illustrations using this wizard is a simple question that might appear in a finance testbank.

Which of the following actions are likely to reduce agency conflicts between stockholders and managers?

- a. Paying managers in-part with stock options.
- b. Making corporate takeovers illegal.
- c. Placing top management on the Board of Directors.
- d. Two choices, A and C, are correct
- e. None of the A-B-C choices are correct

Run the question creator wizard from *Excel*. Click on the cell that is to become the upper left corner of the answer block, say at the bottom of the TQ worksheet. To launch the wizard, run the **ComplexVerbal** macro (**Alt F8**). The wizard presents an introductory message box. Click **YES** after reading the message box (click **NO** to add the question to one of the other *Word* documents besides **titleTQ.doc** or if you launch a new *Testbank Well*).

Complete three pairs of statements, where one part is true and one part false for each pair. The form might appear as follows.

Verbal problem with boolean choices

Question description: What aligns manager and shareholder interests?

True A: Paying managers in-part with stock options.

False A: Paying managers a large fixed salary.

True B: Increasing the threat of corporate takeover.

False B: Making corporate takeovers illegal.

True C: Placing top management on the Board of Directors.

False C: Placing restrictive covenants in debt agreements.

Buttons: Cancel, Make the answer block

Click **Make the answer block** and the question automatically is created in the spreadsheet and in the *Word* file **StructureDownsTQ.doc**. This one testbank question has many different permutations: (1) Only A is correct, (2) only B is correct, (3) only C is correct, (4) D properly specifies A and B as correct and they are, (5) D properly specifies B and C as correct and they are, (6) D properly specifies A and C as correct and they are, (7) E properly states A-B-C are correct and they are, (8) E properly states none are correct and none aren't! The likelihood is $1/5^{\text{th}}$ however, that any choice A through E is the correct answer. Statements in A, B, and C automatically display the respective true or false statements that support each permutation. For the question shown at the top of this discussion, the correct choice is D: statements in positions A and C are true whereas the statement in B is false.

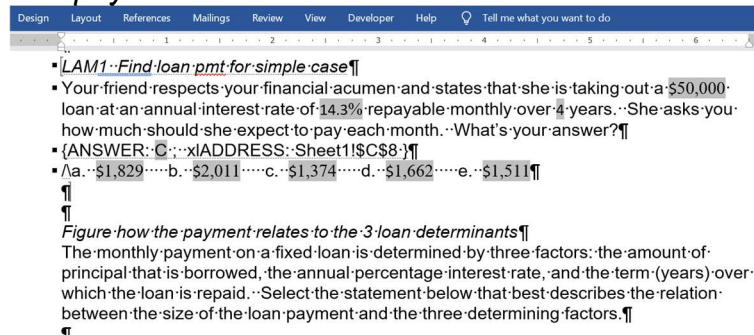
When the question creator wizard finishes, inspect the worksheet setup. Recalculate the spreadsheet a few times by hitting the **F9** key (recalculation also is done by clicking Tools, Options, Calculation, Calculate Now, but hitting **F9** is easier). Observe the varied appearances that this simple problem assumes. Save and leave Open the *Excel* workbook.

Open **StructureDownsTQ.doc** and do the following.

1. Type in the proper location the statement “Which of the following actions are likely to reduce agency conflicts between stockholders and managers?”
2. Highlight the entire question from just before the question code (something like TQ1 to just after e’s answer and include the paragraph mark.) Hit the F9 key to update all the fields. Verify question integrity.
3. Save and close StructureDownsTQ.doc and the *Excel* workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting Maintenance, Update Catalog. The question is now a permanent member of this *Testbank Well*.

Illustration 2 teaches more about algorithmic capabilities in *Excel* with this wizard. Begin by typing out a question in *Word* at the bottom of **titleTQ.doc**, like the second one below: *figure how the payment relates to the 3 loan determinants*.



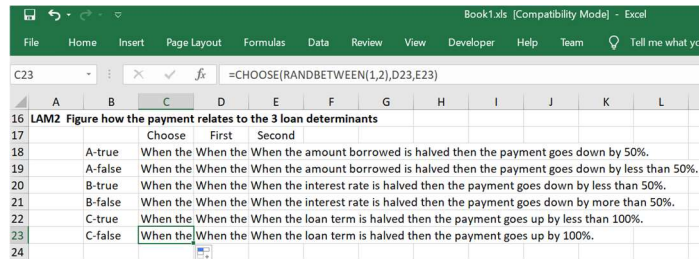
The **ComplexVerbal** wizard prompts for three pairs of statements. Each pair contains one true and one false statement. For the loan payment question in the screenshot above a true statement is that “If the amount borrowed doubles then the loan payment doubles”. That could be entered as the one true statement for A. Equally true, however, is “If the amount borrowed is halved then the loan payment drops 50%”. The strategy for this illustration is to use both true statements for A and then let *Excel* choose which one to draw. Similarly, for the interest rate and for the term write up a pair of true statements for each and a pair of false statements, too. This complexity encourages students to understand rather than memorize the relationship between loan determinants and payment size. A more efficient assessment of attaining learning outcomes occurs, too. Typing and editing in *Word* is easier than in *Excel* so often it’s better to write up the question in *Word* before modeling in *Excel* getting something like below.

LAM1 Find loan pmt for simple case
 Your friend respects your financial acumen and states that she is taking out a \$50,000 loan at an annual interest rate of 14.3% repayable monthly over 4 years. She asks you how much should she expect to pay each month. What's your answer?
 ANSWER: C
 a. \$1,829 b. \$2,011 c. \$1,374 d. \$1,662 e. \$1,511
 Figure how the payment relates to the 3 loan determinants
 The monthly payment on a fixed loan is determined by three factors: the amount of principal that is borrowed, the annual percentage interest rate, and the term (years) over which the loan is repaid. Select the statement below that best describes the relation between the size of the loan payment and the three determining factors.
 a-true OR ("When the amount borrowed doubles then the payment goes up 100%."
 "When the amount borrowed is halved then the payment goes down by 50%.")
 a-false OR ("When the amount borrowed doubles then the payment goes up more than 100%."
 "When the amount borrowed is halved then the payment goes down by less than 50%.")
 b-true OR ("When the interest rate doubles then the payment goes up by less than 100%."
 "When the interest rate is halved then the payment goes down by less than 50%.")
 b-false OR ("When the interest rate doubles then the payment goes up by 100%."
 "When the interest rate is halved then the payment goes down by more than 50%.")
 c-true ("When the loan term doubles then the payment goes down by less than 50%."
 "When the loan term is halved then the payment goes up by less than 100%.")
 c-false ("When the loan term doubles then the payment goes up by less than 100%."
 "When the loan term is halved then the payment goes up by 100%.")

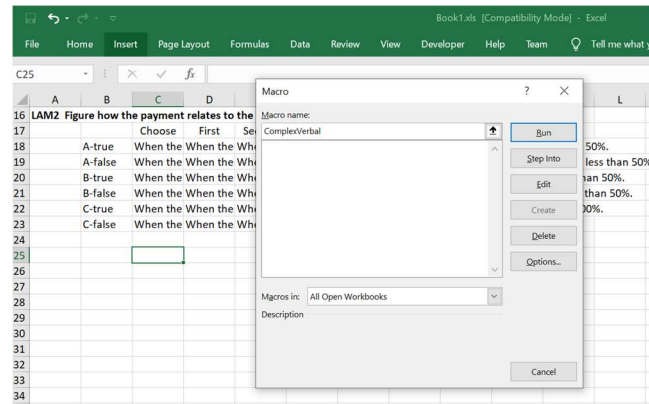
With everything typed in *Word* the next step is make the question setup in *Excel* by using copy/paste procedures. In the *Excel* workbook **title.xls** for the active *Testbank Well* paste in a cell at the bottom of the TQ worksheet the question description shown above from *Word* "Figure how...determinants". Say that paste is to cell A16 like in the screenshot below. Then in row 19 make three short informative labels by typing "Choose" in cell C19, "First" in D19, and "Second" in E19. Copy the first true statement for A from the *Word* document "When the amount borrowed doubles..." and paste into cell D20. Add some labels to cells B20:B25 like A-true, A-false, etc. At this point the worksheet looks similar to below.

	A	B	C	D	E	F	G	H	I	J
13			\$1,511							
14										
15										
16										
17			Choose	First	Second					
18		A-true		When the amount borrowed doubles then the payment goes up 100%.						
19		A-false								
20		B-true								
21		B-false								
22		C-true								
23		C-false								
24										

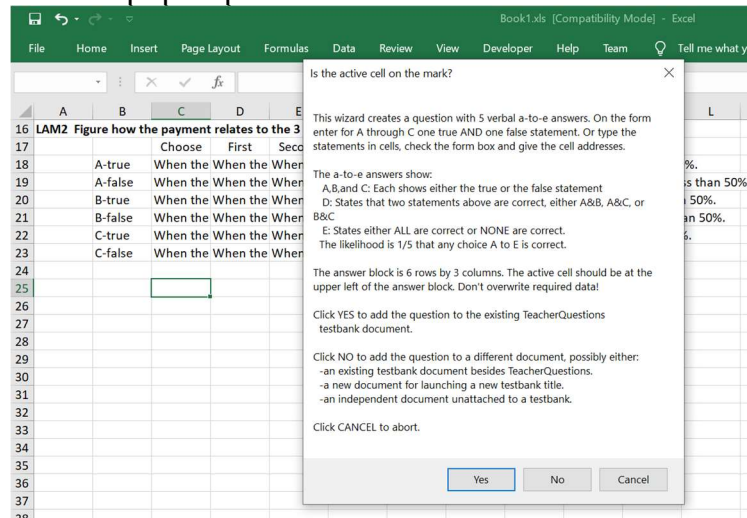
When the second true statement for A "When the amount borrowed is halved..." is pasted into cell E18 then the worksheet looks a little messier since E18 displays over D18. No worries, do it! Likewise, copy the two false statements for A into cells D19 and E19. Then finish copying the 8 statements for selections for B and C from *Word* into the worksheet. In cell C18 type the formula "**=CHOOSE(RANDBETWEEN(1,2), D18, E18)**". Copy the formula in C18 down through C23 (i.e., fill down, hold Ctrl and pull the bottom right corner of C18 down to C23). The question setup should look similar to below.



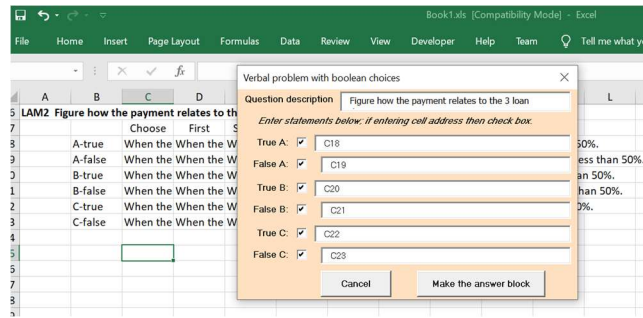
To run the wizard click in cell **C25**. Then hit **Alt F8** and type **ComplexVerbal** in the macro input box. See below.



Click the highlighted **Run** button (if it's not highlighted then *Algogen.xla* is not activated). The message form below pops-up.



Click **Yes**. The question creator form opens. Type or copy/paste the question description in the top box, checkmark the 6 boxes stipulating that the statements are contents of *Excel* cells. For A-true type in the address **C18**, that's first cell beneath the label "Choose" that randomly contains either the first or the second true statement about the relation between loan term and payment amount. For A-false type **C19**, B-true is in cell **C20**, B-false is in cell **C21**, C-true is in cell **C22**, and C-false is in cell **C23**. The completed form appears below.



Click the **Make the answer block** button. When the input box prompts for cells with content that belong in the question body click **Cancel** since there none. Click **OK** when the message box confirms that the job finished. The resulting *Word* document looks like below when the hidden text does not display.

Part LAM Loans and Amortization

Your friend respects your financial acumen and states that she is taking out a \$50,000 loan at an annual interest rate of 14.3% repayable monthly over 4 years. She asks you how much should she expect to pay each month. What's your answer?
a. \$1,829 b. \$2,011 c. \$1,374 d. \$1,662 e. \$1,511

Insert question in this paragraph.

- a. When the amount borrowed is halved then the payment goes down by less than 50%.
- b. When the interest rate doubles then the payment goes up by less than 100%.
- c. When the loan term doubles then the payment goes up by less than 100%.
- d. Two choices, B and C, are correct
- e. The three A-B-C choices are all correct

Figure how the payment relates to the 3 loan determinants

The monthly payment on a fixed loan is determined by three factors: the amount of principal that is borrowed, the annual percentage interest rate, and the term (years) over which the loan is repaid. Select the statement below that best describes the relation between the size of the loan payment and the three determining factors.

- a-true OR("When the amount borrowed doubles then the payment goes up 100%."
- "When the amount borrowed is halved then the payment goes down by 50%.")

The square brackets [] surround the question bookmark. The content from field links is shaded. The *Word* File > Options > Advanced > Show document content > field shading setting toggles shading on and off. Also on that page is the show Bookmarks [] setting. The document now contains its second question. On the Home tab click the ¶ symbol to display the hidden text. The window refreshes as:

Part LAM Loans and Amortization¶
¶
LAM1:Find loan pmt for simple case¶
Your friend respects your financial acumen and states that she is taking out a \$50,000 loan at an annual interest rate of 14.3% repayable monthly over 4 years. She asks you how much should she expect to pay each month. What's your answer?¶
{ANSWER:C;xADDRESS:Sheet1!\$C\$8}¶
/a..\$1,829...b..\$2,011...c..\$1,374...d..\$1,662...e..\$1,511¶
¶
LAM2:Figure how the payment relates to the 3 loan determinants¶
Insert question in this paragraph.¶
{ANSWER:B;xADDRESS:Sheet1!\$C\$25}¶
/a..When the amount borrowed is halved then the payment goes down by less than 50%.¶
/b..When the interest rate doubles then the payment goes up by less than 100%.¶
/c..When the loan term doubles then the payment goes up by less than 100%.¶
/d..Two choices, B and C, are correct¶
/e..The three A-B-C choices are all correct¶
¶
Figure how the payment relates to the 3 loan determinants¶
The monthly payment on a fixed loan is determined by three factors: the amount of principal that is borrowed, the annual percentage interest rate, and the term (years) over

Highlight the question body: "The monthly payment ... and the three determining factors." Cut these two sentences and paste them over the "Insert question in this paragraph." Delete the content outside the bookmark beginning "Figure how ..." and

including all the statements that were written, edited, and then cut and pasted into *Excel*.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2	LAM1 Find the monthly loan payment for the simplest case												
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	LAM2 Figure how the payment relates to the 3 loan determinants												
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													

The *Word* document contains:

- Part LAM--Loans and Amortization¶
- ¶
- ¶
- LAM1--Find loan pmt for simple case¶
- Your friend respects your financial acumen and states that she is taking out a \$50,000 loan at an annual interest rate of 14.3% repayable monthly over 4 years. She asks you how much should she expect to pay each month. What's your answer?¶
- {ANSWER: C; ; xADDRESS: Sheet1!\$C\$8;}¶
- /a..\$1,829.....b..\$2,011.....c..\$1,374.....d..\$1,662.....e..\$1,511¶
- ¶
- ¶
- LAM2--Figure how the payment relates to the 3 loan determinants¶
- The monthly payment on a fixed loan is determined by three factors: the amount of principal that is borrowed, the annual percentage interest rate, and the term (years) over which the loan is repaid. Select the statement below that best describes the relation between the size of the loan payment and the three determining factors.¶
- {ANSWER: B; ; xADDRESS: Sheet1!\$C\$25;}¶
- /a..When the amount borrowed is halved then the payment goes down by less than 50%.¶
- /b..When the interest rate doubles then the payment goes up by less than 100%.¶
- /c..When the loan term doubles then the payment goes up by less than 100%.¶
- /d..Two choices, B and C, are correct¶
- /e..The three A-B-C choices are all correct¶
- ¶
- ¶

Note that to edit an answer statement appearing above in the *Word* document for question LAM2, say to improve readability, requires editing (only) the relevant statement in the *Excel* cell range D18:E23. Also notice that in the above drawing of question LAM2 the answer is B. This means that answer choice b displays a true statement, choices a and c display false statements, and choices d and e display irrelevant statements. To get a new drawing of LAM2 just switch to *Excel* and hit the F9 key. Then switch back to *Word*, highlight the question and hit the F9 key. See something like below.

- ¶
- LAM2--Figure how the payment relates to the 3 loan determinants¶
- The monthly payment on a fixed loan is determined by three factors: the amount of principal that is borrowed, the annual percentage interest rate, and the term (years) over which the loan is repaid. Select the statement below that best describes the relation between the size of the loan payment and the three determining factors.¶
- {ANSWER: E; ; xADDRESS: Sheet1!\$C\$25;}¶
- /a..When the amount borrowed is halved then the payment goes down by less than 50%.¶
- /b..When the interest rate doubles then the payment goes up by 100%.¶
- /c..When the loan term is halved then the payment goes up by 100%.¶
- /d..Two choices, A and C, are correct¶
- /e..None of the A-B-C choices are correct¶
- ¶

Since correct answer E states that None of the statements are true means that many, many students unfortunately will get this particular drawing wrong since they tend to dislike choosing this answer; apparently teachers seldom use it. The algorithm has no conscience and makes this selection the correct choice 10% of the time though there

are dozens of unique views when None are true since 3 false statements are drawn from a pool of 6. You can highlight the question, copy it (Ctrl c), 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.

Algorithm 4. The Simplistic Verbal Wizard

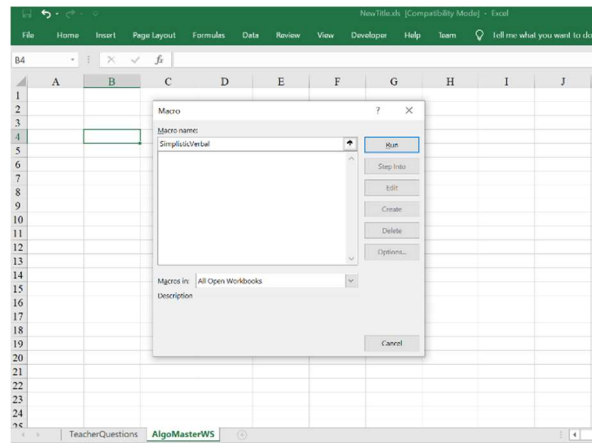
Macro-name = SimplisticVerbal

Say that you have a *Word* document **OldExam.doc** that contains many questions. Even though this document is not algorithmic, you want to convert the questions into algorithmic ones. Suppose you'll start with the question below on the yield curve.

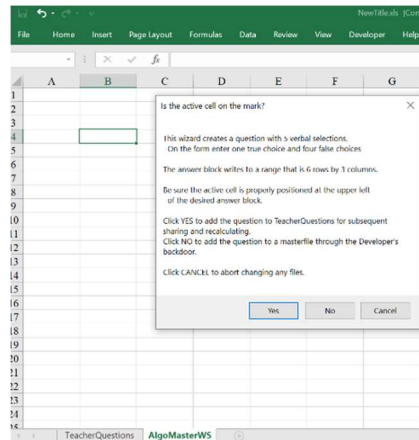
Which characteristic best describes the Treasury yield curve?

- a. The curve normally begins with a steep upward slope that flattens toward the right.
- b. Coordinates of the yield curve are interest rate on horizontal axis and term-to-maturity on vertical axis.
- c. The curve normally begins flat and steepens downward toward the right.
- d. The curve depicts the spread between corporate bond yields and Treasury bonds.
- e. Coordinates of the yield curve are yield-to-maturity on horizontal axis and term-to-maturity on vertical axis.

The correct answer for the preceding static question is always the sentence in choice “a”. Adding this question to the testbank allows a question in which the five choices randomly rearrange on each version. Always the same sentence choices appear, but the odds are 1/5 that the correct phrase is in position “a”, 1/5 that it’s in “b”, ..., and 1/5 that it’s in “e” (there are 120 unique permutations of the five sentences). Hit **Alt F8** and type **SimplisticVerbal** into the Macro form.



Click **Run** and see the form below.



Click **YES** and see the question creator form.

Enter a description for this question into the top text box (see the completed form below). Click on *Word* to restore **OldExam.doc**. Click to highlight the sentence showing the correct answer (don't highlight the letter selection "a"). While the sentence is highlighted, right-click and copy. This copies the selection to the Windows clipboard (equivalent to clicking the *Word* copy icon). Click on *Excel* to restore the Simplistic Verbal form. Click in the textbox **Correct selection**, and right-click **Paste**. Switch to *Word* and copy the first wrong selection (that is, the sentence following "b"). Paste this into the *Excel* form **False selection 1**. Repeat for selections c, d, and e.

ASIDE: Notice that an alternative procedure would have been to paste each selection from the *Word* question into a unique *Excel* cell. For example, paste the correct sentence into worksheet cell B4 while cells B5 to B8 could contain the 4 false sentences. In that case, leave row 9 blank and click cell B10 to make it the active cell at the upper right of the answer block, then run the macro. For this alternative procedure, instead of typing the sentence in the Correct selection textbox, only type B4. Type B5 in the False selection 1 box, etc. Then check all the checkboxes indicating that the form has cell addresses, not sentences.

When the form appears similar to below, click **Make the answer block**.

Simplistic Verbal Question

Question description: Characteristics of the yield curve

Enter statements below; if entering cell address then check box.

Correct selection ☐ The curve normally begins with a steep upward slope that flattens toward the right.

False selection 1 ☐ Coordinates of the yield curve are interest rate on horizontal axis and term-to-maturity on vertical axis.

False selection 2 ☐ The curve normally begins flat and steepens downward toward the right.

False selection 3 ☐ The curve depicts the spread between corporate bond yields and Treasury bonds.

False selection 4 ☐ Coordinates of the yield curve are yield-to-maturity on horizontal axis and term-to-maturity on vertical axis.

Cancel Make the answer block

When the input box prompts for cells with content that belong in the question body click **Cancel** since there none. Click **OK** when the message box confirms that the job finished. Finalize the *Word* and *Excel* documents, then Save and Exit. Eventually launch *Algogen* to add this new question to the catalog files.

Algorithm 5. The Three Correct Pairs Wizard

Macro-name = *ThreeCorrectPairs*

The Three Correct Pairs question creator prompts for 3 pairs of inputs. Each pair has two parts that correspond correctly. The five selections, A-to-E, present only one selection containing a correct pair. The correct pair, and its location too, are chosen randomly. The four wrong answers combine parts from non-corresponding pairs. The following is a question that might appear in a biology testbank.

Which statement most accurately describes bones in the cranium?

- a. the occipital articulates with all other parts of the cranium
- b. the sphenoid is at the base of the cranium
- c. the malar is at the base of the cranium
- d. the sphenoid articulates with all other parts of the cranium
- e. the malar form the prominence of the cheeks

The discussion below explains how to use the Three Correct Pairs wizard to add the preceding question to "StructureDownsTQ.doc". The reader may copy the statements from this help guide and paste them into *Word* and *Excel*, as appropriate, to serve as a tutorial

Start *Word* and open **StructureDownsTQ.doc**. Move to the blank space preceding the last paragraph that states "END OF DOCUMENT". Type or copy a rough draft of the question body:

Which statement most accurately describes bones in the cranium?

For this simplistic question there are no links in the question body. Save and close **StructureDownsTQ.doc**

Open the *Excel* workbook accompanying *Algogen*. Activate the worksheet named "TeacherQuestions" by clicking on its bottom tab. Scroll past the last question on this worksheet, leaving about 4 blank rows to serve as a neutral zone between the old and new questions. Suppose, for example, that we wish to start the question in cell A45. In cell A45 type a brief description of the question. For example, click on cell A45 and type or copy

Bones in the cranium

The *Excel* setup is minimal because the Three Correct Pairs wizard prompts for all necessary information.

Click on cell B48. This becomes the upper left corner of the answer block (for more information about answer blocks read the help topic “Creating New Questions: the role of Excel wizards”). To launch the wizard, run the macro **ThreeCorrectPairs**. The wizard presents an introductory message box. Click **YES** after reading the message box (click **NO** to add the question to one of the other *Word* documents besides **titleTQ.doc** or if you launch a new *Testbank Well*).

Enter an adequate question description, such as

Identify bones in the cranium

The form offers three pairs of blanks. The two parts of each pair comprise a correct answer.

Type or copy the following statements into the form:

pair 1 part 1:

the occipital

pair 1 part 2:

is at the base of the cranium

pair 2 part 1:

the sphenoid

pair 2 part 2:

articulates with all other parts of the cranium

pair 3 part 1:

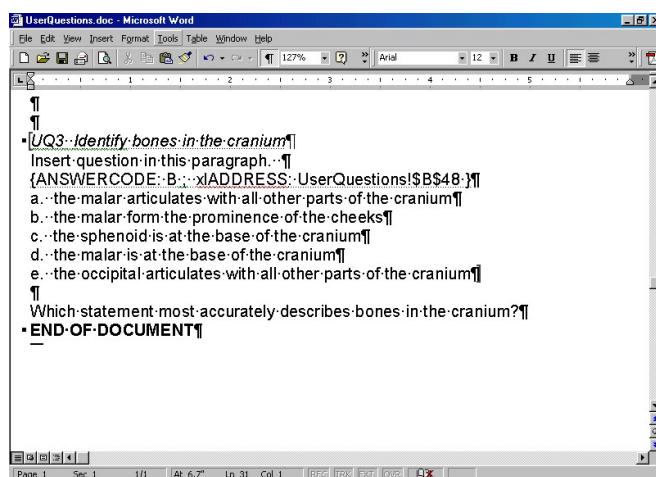
the malar

pair 3 part 2:

form the prominence of the cheeks

Inspect the choices for “What type of entry does each part contain?” The default setting “Words” is correct for this set-up. Click **Make the answer block** and be patient. The wizard eventually prompts for inputs to insert into the question body. There are none for this question, so respond to this query by clicking Cancel. When the wizard finishes there are five pairs in the range B49:C53 that correspond to the five A-to-E choices in the *Word* document. One pair, randomly selected, is a correctly matched pair and the other four are wrongly matched. The letter answer in B48 identifies the correct answer. Recalculate the spreadsheet a few times by hitting the **F9** key (recalculation also is done by clicking Tools, Options, Calculation, Calculate Now, but hitting **F9** is easier). Observe the different appearances that this simple problem assumes.

Inspect the *Word* file **StructureDownsTQ.doc**. Some characters possess hidden formatting. To see them, click **Tools, Options, View, All**. The problem appears similar to the window below



Highlight the text “Which statement ... cranium?”, cut and paste the text over the phrase “Insert question in this paragraph. ”

The Three Correct Pairs question creator easily accommodates inputting cell addresses into the form, and even using pairs in which one part is a number while the other part is a phrase. Suppose that in the preceding illustration correct numerical choices appear in the worksheet range A43:A45, and corresponding correct pairs (phrases) appear in the range C43:C45. When the question creator wizard prompts for the parts of each pair, simply enter the respective cell address. Properly select the type of each entry, and make the question.

As always, verify the integrity of the question. Highlight the entire question, and hit **F9** to ascertain that all fields update properly. Save and close **StructureDownsTQ.doc** and the **Excel** workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting Maintenance, Update Catalog. The question is now a permanent member of your personalized *Algogen* testbank.

Algorithm 6. The Recombine One Pair Wizard *Macro-name = OneCorrectPair*

The Recombine One Pair wizard prompts for 1 pair of inputs that correspond to form a correct answer. Each part of the pair may be either a number or a phrase, or even a reference to a cell address containing a number or phrase. One of the five selections in A-to-E contains the correct pair. The four wrong answers contain at least one part from the correct pair, but the other part contains a decoy that makes the answer false. The following is a question that might appear in a statistics testbank.

Careful analysis of a production process collects the observations below.

run number	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
run time	12	32	18	14
quantity	48	137	68	62

The table shows the number of minutes the run executed and the number of units

produced. You are investigating the production rate. What is the mean and standard deviation of the quantity produced per minute?

- a. the mean is 4.53 and the standard deviation is 0.29
- b. the mean is 3.75 and the standard deviation is 0.29
- c. the mean is 4.12 and the standard deviation is 0.29
- d. the mean is 4.53 and the standard deviation is 0.36
- e. the mean is 4.12 and the standard deviation is 0.36

The discussion below explains how to use the Recombine One Pair wizard to add the preceding question to **StructureDownsTQ.doc**. The reader may copy the statements from this help guide and paste them into *Word* and *Excel*, as appropriate, to serve as a tutorial.

Start *Word* and open **StructureDownsTQ.doc**. Move to the blank space preceding the last paragraph that states “END OF DOCUMENT”. Type or copy a rough draft of the question body:

Careful analysis of a production process collects the observations below.

The table shows the number of minutes the run executed and the number of units produced. You are investigating the production rate. What is the mean and standard deviation of the quantity produced per minute?

The table is a link that the wizard copies into the document. Later you’ll come back and edit the question. For now, Save and Close **StructureDownsTQ.doc**

Open the *Excel* workbook accompanying *Algogen*. Activate the worksheet named “TeacherQuestions” by clicking on its bottom tab. Scroll past the last question on this worksheet, leaving about 4 blank rows to serve as a neutral zone between the old and new questions. Suppose, for example, that we wish to start the question in cell A39. In cell A39 type a brief description of the question. For example, click on cell A39 and type or copy “Find the mean and standard deviation for a production process”

In cell B41 type

run number

in cell B42 type

run time

and in cell B43 type

quantity

In cells C41 to F41 type the numbers 1, 2, 3, and 4, respectively. This row is a heading for the table.

In cells C42 to F42 enter the observations for run time. Type in C42

=randbetween(8,16)

and hit the enter key.

The *Excel* help library explains that “randbetween” is a function from the **Analysis-ToolPak** add-in that randomly chooses an integer between the two numbers in parentheses. Every recalculation of the worksheet returns a new value for randbetween. For cell C42 a random number between 8 and 16 is chosen. *Excel* functions such as “randbetween”, “choose”, and “index”, as well as many others, provide the question designer with substantial creative flexibility.

If cell A8 returns the error “#NAME” then the **Analysis-ToolPak** add-in is disabled. Click on Tools, Add-ins, and checkmark **Analysis-ToolPak**. The installation instructions contain more information about add-ins.

Click on cell C42. Click on the little box in the lower right corner of cell C42, and drag the box over cells D42 to F42. Release the click. Now click on cell D42, and in the formula click and drag the cursor over the the numbers in parenthesis. Overwrite so that the formula appears

=randbetween(25,35)

Edit the numbers in cells E42 and F42 analogously.

Highlight the range C42 to F42. Click on the little box in the lower right corner and drag it over cells C43 to F43. Edit the numbers in the randbetween functions to give ranges like the ones show the question illustration above.

In cell B45 type

q/time

and hit enter. In cell C45 type

=C43/C42

and hit enter. Now C45 contains the quantity divided by the number of minutes for run 1. Click on the little box in the lower right corner of cell C45, and drag the box over cells D45 to F45. Release the click. All cells should now be correctly computing the quantity per minute for the respective run.

In cell B47 type

mean =

and hit enter. In cell C47 type

=average(C42:F42)

and hit enter. *Excel* documentation explains that average() is a function that returns the average of all cells from the range in parentheses.

In cell B48 type

standard deviation =

and hit enter. In cell C48 type

=stdev(C42:F42)

and hit enter. *Excel* documentation explains that stdev() is a function that returns the standard deviation of all cell from the range in parentheses.

The *Excel* setup is complete and now is the time to run the question creator wizard.

Click on cell B51. This becomes the upper left corner of the answer block. To launch the wizard, run the macro **OneCorrectPair**. The wizard presents an introductory message box. Click **YES** after reading the message box (click **NO** to add the question to one of the other *Word* documents besides **titleTQ.doc** or if you launch a new *Testbank Well*).

Enter an adequate question description, such as

Find the mean and standard deviation for a production process

The form offers a blank for part 1 and another blank for part 2. For part 1 type

C47

and for part 2 type

C48

The contents of both cells are numbers, so set the Type of Entry to “Cell address with numbers”. If one of the parts contained a word or sentence, you would subsequently be prompted for false decoys. With a number, however, *Algogen* automatically creates numerical decoys. Click **Make the answer block** and patiently wait. The wizard prompts for the address of cells to copy into the question body. Type

B41:F43

and click **OK**. The entire contents of the table copy as one field. For the next prompt about inputs, click **Cancel**.

When the question creator wizard finishes, inspect the worksheet setup. Format cells appropriately. For example, center the table entries, underline the run numbers, right justify row labels, format numbers to two decimal places, etc. Recalculate the spreadsheet a few times by hitting the **F9** key (recalculation also is done by clicking **Tools, Options, Calculation, Calculate Now**, but hitting **F9** is easier). Observe the diverse appearances that this simple problem assumes. Save the *Excel* workbook.

Open **StructureDownsTQ.doc**, click on **Tools, Options, View**, checkmark the boxes for **Bookmarks** and **All**, and click **OK**. Inspect the question. Do the following.

1. Click and drag the statements for the question body into the proper location. The table goes in the middle of the question body, as illustrated previously.
2. Highlight the entire question and hit **F9** to update all fields. The table takes on the proper shape.
3. Save and close **StructureDownsTQ.doc** and the *Excel* workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting **Maintenance, Update Catalog**. The question is now a permanent member of your personalized *Algogen Testbank Well*.

Algorithm 7. The True-False Wizard

Macro-name = StandardTrueFalse

The wizard prompts for two statements: one true and one false. The following is a question that might appear in a history testbank.

Article 2 of the constitution gives exclusive right for appointing presidential electors to the state legislature
a. True b. False

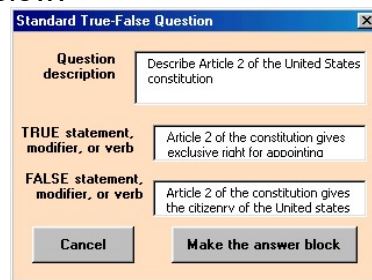
The preceding statement is true. The false permutation of this question is shown below.

Article 2 of the constitution gives the citizenry of the United states exclusive rights for electing the president
a. True b. False

Run the question creator wizard from *Excel*. Click on the cell that is to become the upper left corner of the answer block. To launch the wizard, run the macro **StandardTrueFalse**. The wizard presents an introductory message box. Click “YES”

after reading the message box (click **NO** to add the question to one of the other *Word* documents besides **titleTQ.doc** or if you launch a new *Testbank Well*).

Enter an adequate question description, and the true and false statements shown above. The form appear as below:



After the wizard is finished, open **StructureDownsTQ.doc**, click on Tools, Options, View, checkmark the boxes for Bookmarks and All, and click Ok. Inspect the question. Do the following.

1. Eliminate the phrase “insert statement here.”
2. Highlight the entire question from just before the question code o just after “b. False.” Hit the **F9** key to update all the fields. Verify question integrity.
3. Save and close **StructureDownsTQ.doc** and the *Excel* workbook.

Add the question to the *Algogen* list by starting *Algogen*, and selecting **Maintenance, Update Catalog**.

Algorithm 8. The Three Choices Wizard *Macro-name = ThreeChoice*

This wizard creates a question with 3 selections. On the form enter one true choice and two false choices. Later, if you wish, enter a D and/or E choice with contents satisfying your objective. The answer block writes to a range that is 4 rows by 3 columns.