OPENRULES®

Open Source Business
Decision Management System
Release 6.1

Preparing a Tax Return Using OpenRules® Dialog (Dialog1040EZ)

Tutorial

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Introduction

In this tutorial we explain how to implement a rules-based application that calculates tax returns using the notorious US tax form 1040EZ. This tutorial is written in the form of a dialog between two people:

- User – a person who wants to learn how to write OpenRules-based application
- OR – a representative of OpenRules technical support who explains how to do it.

A user is not expected to be a software developer but rather a business analyst who is familiar with Excel and who has already looked at the OpenRules document "Getting Started" that includes several basic examples.

This tutorial explains how to use OpenRules® Dialog (ORD) to create a web-based application that drives a user dialog during which only necessary questions from the 1040EZ form are being asked, all other answers are automatically calculated, and a ready to go tax return in the PDF format is being produced.

Another implementation approach implements only tax calculation logic without a GUI. It is based on the Decision Model and can be incorporated in any application as a pure decision service – see http://openrules.com/pdf/Tutorial.Decision1040EZ.pdf.

Business Case

OR. We will prepare the notorious US tax form 1040EZ used by many US taxpayers to report on their revenue and expenses and calculate whether the taxpayer still owes additional money or can expect a refund.

User. I did not use it myself but I know how frustrated some of my colleagues were when they tried to fill out this form themselves.

OR. There are plenty of web-based applications that help people to do it. While the form 1040EZ is supposed to be used only in simple cases, the business logic behind this form is not so simple especially when a taxpayer was shown as a dependent by his/her parents or somebody else. The actual form has only 2 pages and in many cases only the first page is needed. The second page has to be filled only when a taxpayer is shown as dependent. We also have to keep in mind the eligibility criteria that specify when to use and not to use this form.

User. Where can we get the form?

OR. We downloaded this form from the IRS website in 2004 and used this form the demonstrate how to use OpenRules Forms. For your convenience, the form 1040EZ is presented in the Appendix below. We will use the tax form for 2003 as the example for our application. You may download the latest 1040EZ form from http://www.irs.gov/pub/irs-pdf/f1040ez.pdf. The instructions can be found at http://www.irs.gov/pub/irs-pdf/i1040ez.pdf. As you can see, the form is self-explanatory and people should be able to fill it out without external help.

User. I noticed that the official 1040EZ instructions have more than 35 pages, probably to cover all possible situations. However, our real OpenRules-based application is also not going to be easy, so I'd appreciate it if you would explain how to handle not just simple cases but also much more complex business scenarios.

OR. We plan to build a web application Dialog1040EZ that provides a complete 1040EZ GUI which allows people to enter only the necessary information, calculates a refund and even prints the return in a pdf format.

Web Questionnaire "Dialog1040EZ"

OR. In this section we will discuss how to build a web-based application that interactively fills out the form 1040EZ and even prints it out as ready to be filed pdf document. We will not use "The Decision Model" but rather will utilize the web development facilities provided by OpenRules® Rule Dialog (ORD™). Again we will consider different implementation options and discuss all of the pros and cons.

A ready to go application is a part of the complete OpenRules installation – you can find it in the sample project Dialog1040EZ.

Starting with GUI

OR. When building a GUI, we need to concentrate on what the user of the GUI will actually see and how our questionnaire will interact with this user. So, we will start with the GUI design. With OpenRules® Rule Dialog you do not have to be an expert in different web technologies – you do not even have to be an expert in HTML (but some basic knowledge would be helpful).

User. It is good because my web knowledge is limited to the HTML basics.

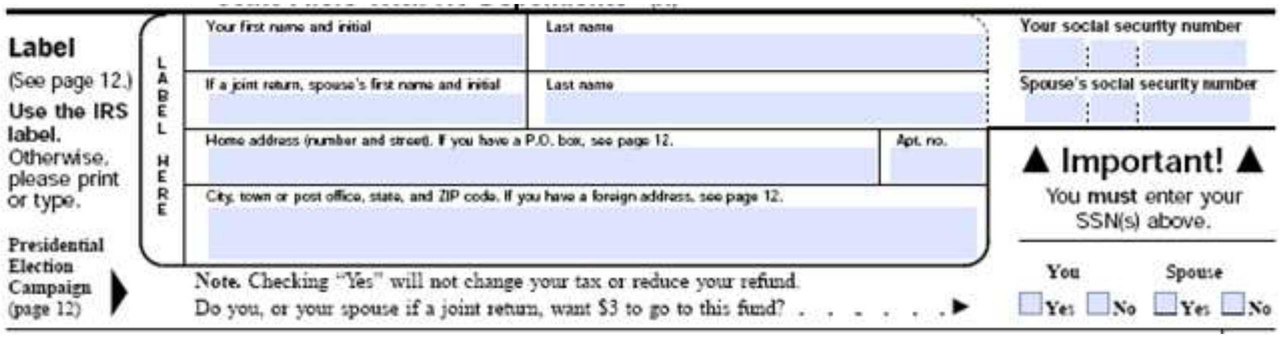
OR. We will use only Excel tables to represent different web pages – this time such Excel tables have type "Layout" and look very similar to what you want to see at your web-based GUI. We still will need rules but this time there will be two types of rules,

- Interaction Rules that control interaction between user and our application
- Business Rules that support business logic (similar to 1040EZ calculation rules defined in http://openrules.com/pdf/Tutorial.Decision1040EZ.pdf.

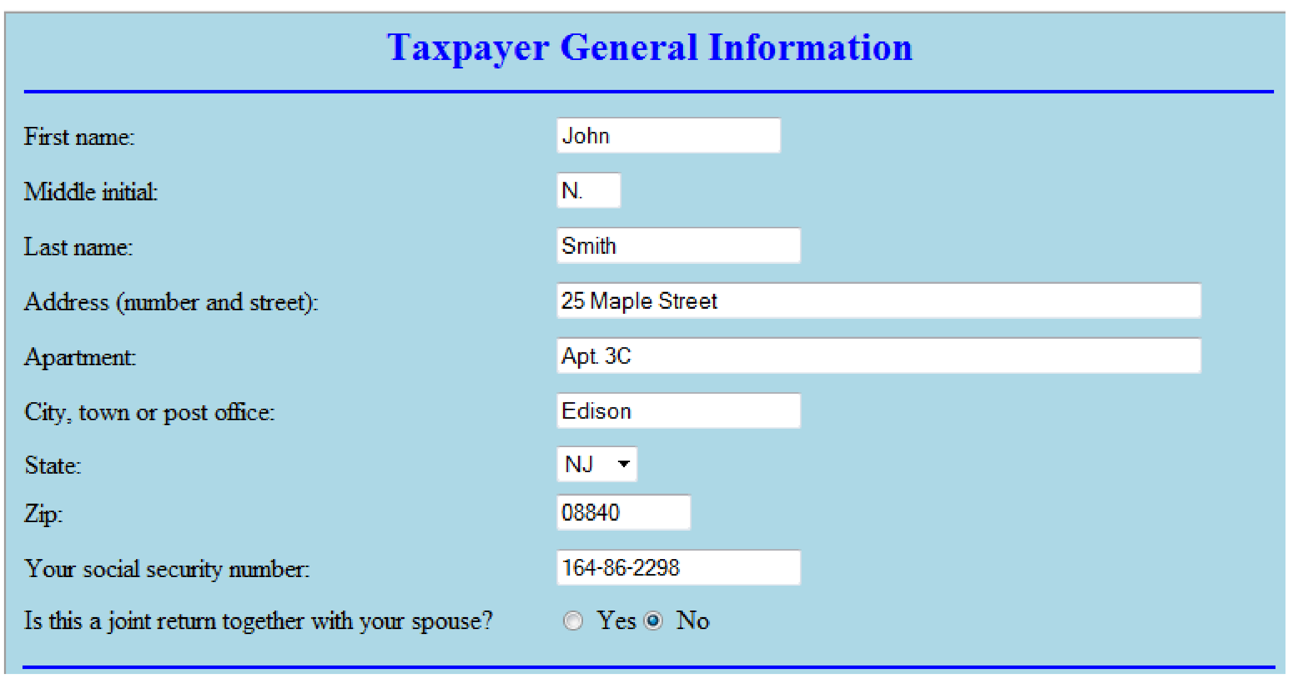
Let’s try to create sketches of different pages for our 1040EZ questionnaire.

User. Perhaps we should look at the form 1040EZ and consider different sections of this form as a prototype of our GUI.

OR. That’s a good approach. Let me deal with the very first section myself. It contains general information about the taxpayer.



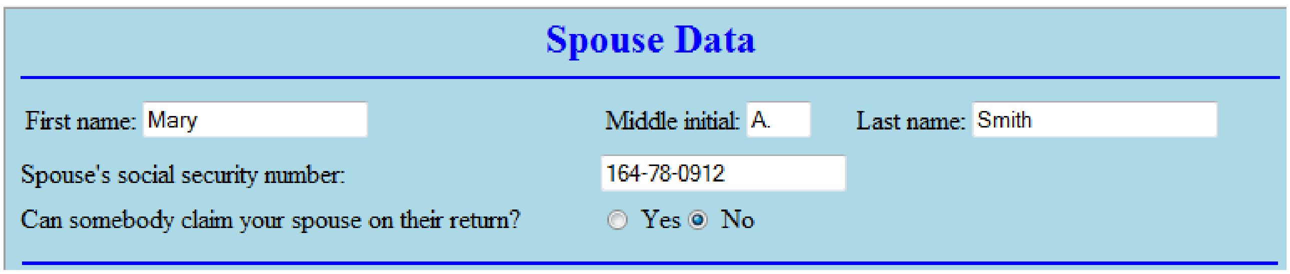
Our first attempt may not be a very fancy GUI, but we can always improve it later on using different style sheets. So, I’d expect that the first page of our future dialog will look like on this picture.



While this page looks similar to the 1040EZ form, I did not follow the form literally. The reason is that our web dialog should ask a user only what is really necessary and figure out answers to all other questions by itself. This will be our leading design principle. For example, on this page, we are not asking for the Spouse’s social security number (SSN) because we will need it only if we know that this is a joint return. We will also discuss how to represent validation logic like "You must enter your SSN" but we will do it a little bit later. So, what will be the next page?

User. The next 1040EZ section is about income information.

OR. Yes, but first we have to complete questions about the Spouse in case if the answer to the question "Is this a joint return together with your spouse?" is "Yes". I'd suggest creating a special page that collects all necessary information about the spouse. Here is a possible view:


Spouse Data

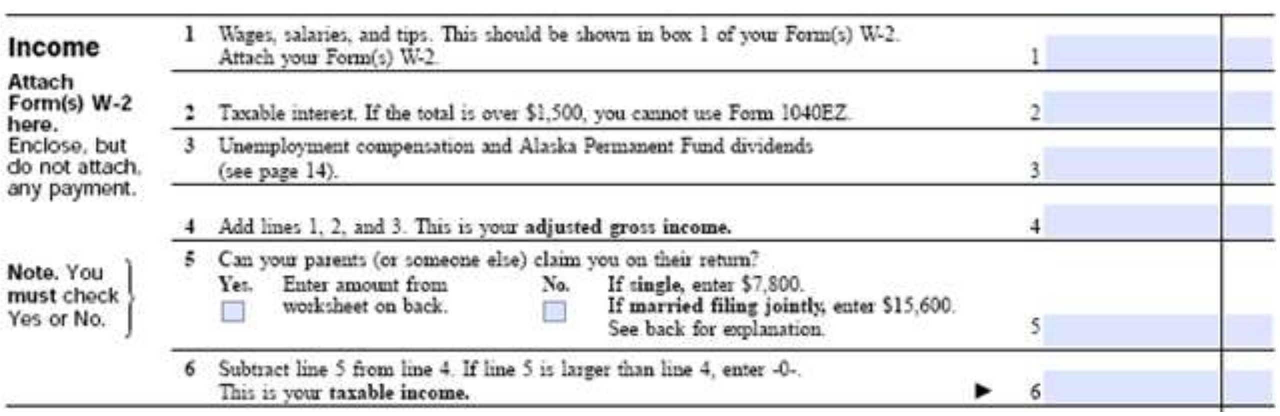
First name: Mary Middle initial: A. Last name: Smith

Spouse's social security number: 164-78-0912

Can somebody claim your spouse on their return? ○ Yes ◉ No

Note that I added one more question (the last one) that is not on the first section of the form 1040EZ, but you and I already know that we would need an answer to this question when we calculate a dependent amount. Now please try to design a page for the income information.

User. Here is the Income section from the form 1040EZ:

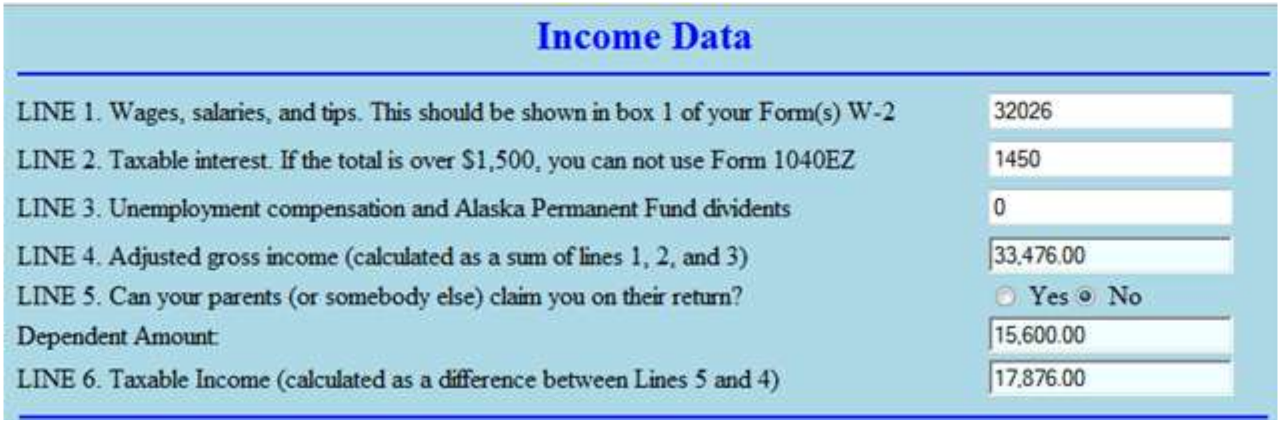

Income

Attach Form(s) W-2 here.
Enclose, but do not attach, any payment.

Note. You **must check** Yes or No.

1	Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2. Attach your Form(s) W-2.	1
2	Taxable interest. If the total is over $1,500, you cannot use Form 1040EZ.	2
3	Unemployment compensation and Alaska Permanent Fund dividends (see page 14).	3
4	Add lines 1, 2, and 3. This is your **adjusted gross income.**	4
5	Can your parents (or someone else) claim you on their return? **Yes.** Enter amount from worksheet on back. **No.** **If single,** enter $7,800. **If married filing jointly,** enter $15,600. See back for explanation.	5
6	Subtract line 5 from line 4. If line 5 is larger than line 4, enter -0-. This is your **taxable income.** ▶	6

So, we may present it as follows:

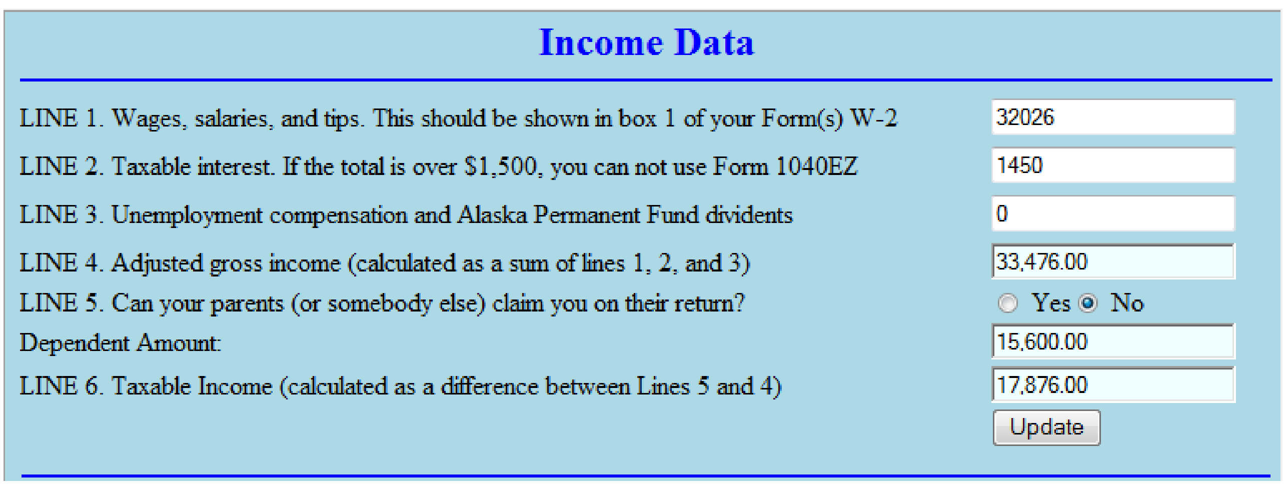


OR. It looks almost exactly like the form itself – all 6 lines are here.

User. I assumed that on this form Adjusted Gross Income, the Dependent Amount, and Taxable Income, are each calculated automatically and cannot be changed by the user. I made this fields a little bit darker than other fields.

OR. What if our user were to change wages or taxable interest? Then the other fields should be recalculated, right?

User. OK, I will add a button "Update" that will do it:



OR. Good, let's move to the next section.

User. Here are the lines for calculation of the Dependent Amount from the second page of the form 1040EZ:

A. Amount, if any, from line 1 on front + 250.00 Enter total ▶	**A.**	
B. Minimum standard deduction	**B.**	750.00
C. Enter the **larger** of line A or line B here	**C.**	
D. Maximum standard deduction. If **single,** enter $4,750; if **married filing jointly,** enter $9,500	**D.**	
E. Enter the **smaller** of line C or line D here. This is your standard deduction	**E.**	
F. Exemption amount. • If single, enter -0-. • If married filing jointly and— —both you and your spouse can be claimed as dependents, enter -0-. —only one of you can be claimed as a dependent, enter $3,050.	**F.**	
G. Add lines E and F. Enter the total here and on line 5 on the front	**G.**	

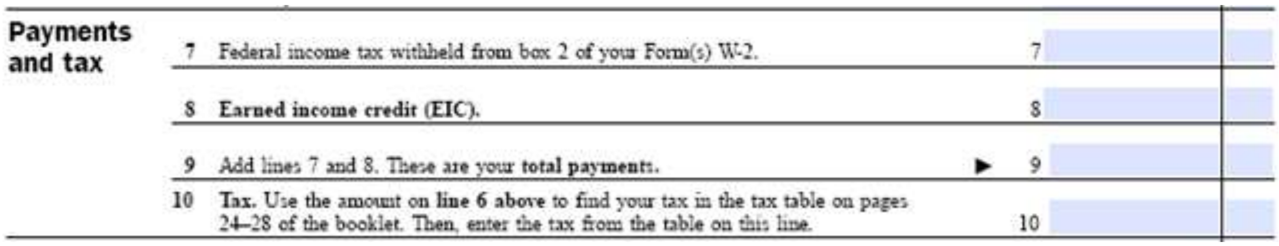
It is only natural to create a similar GUI page.

Worksheet For Dependents

A. Amount, if any, from LINE 1 + $250.00	32,276.00
B. Minimum standard deduction	750.00
C. The larger of line A or line B	32,276.00
D. Maximum standard deduction: $4,750 if single, $9,500 if married filing jointly	9,500.00
E. The smaller of lines C or D. This is your standard deduction	9,500.00
F. Exemption amount: 0 - if single; 0 - if married filling jointly and both you and your spouse can be claimed as dependents; $3,050 - if married filling jointly and only one of you can be claimed as dependents	0.00
G. TOTAL (a sum of lines E and F)	9,500.00

I will assume that all fields on this page are read-only because they all can be automatically calculated based on the answers to preceding questions.

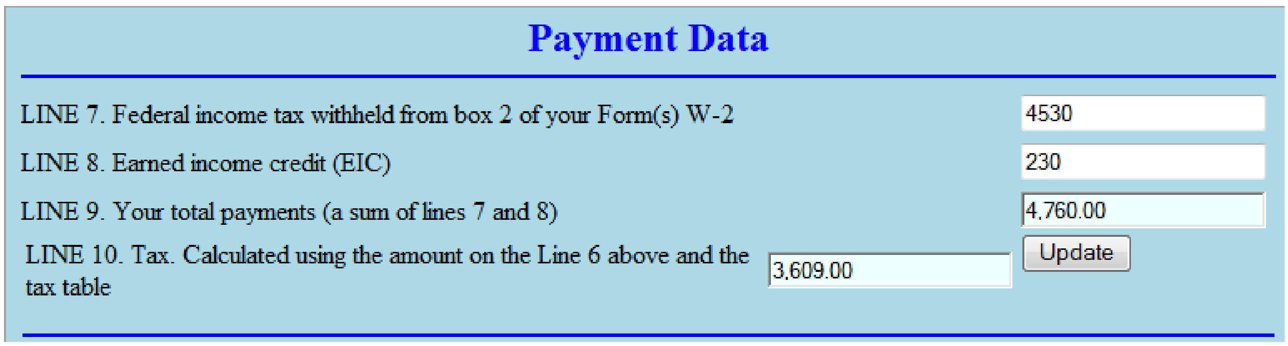
OR. I agree. Now let's design the "Payments and tax" section:



Payments and tax

7	Federal income tax withheld from box 2 of your Form(s) W-2.	7
8	**Earned income credit (EIC).**	8
9	Add lines 7 and 8. These are your **total payments.** ▶	9
10	**Tax.** Use the amount on **line 6 above** to find your tax in the tax table on pages 24–28 of the booklet. Then, enter the tax from the table on this line.	10

User. Here it goes.



Payment Data

LINE 7. Federal income tax withheld from box 2 of your Form(s) W-2 — 4530

LINE 8. Earned income credit (EIC) — 230

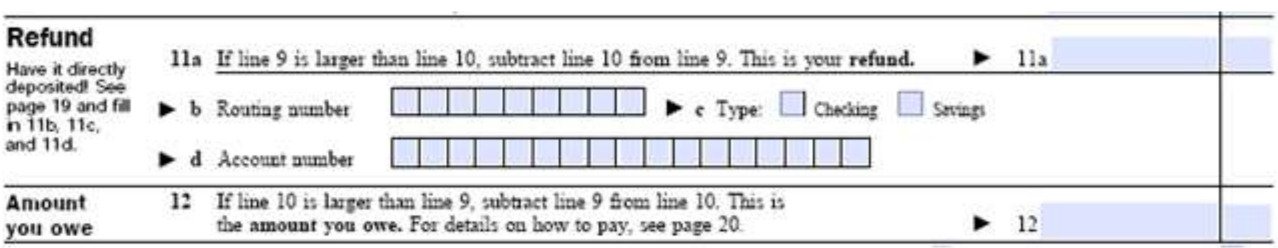
LINE 9. Your total payments (a sum of lines 7 and 8) — 4,760.00

LINE 10. Tax. Calculated using the amount on the Line 6 above and the tax table — 3,609.00

Update

OR. I can see that this time you already added the button "Update" to re-calculate Line 9 and Line 10.

User. And here is the final section:



Refund

Have it directly deposited! See page 19 and fill in 11b, 11c, and 11d.

11a If line 9 is larger than line 10, subtract line 10 from line 9. This is your **refund.** ▶ 11a

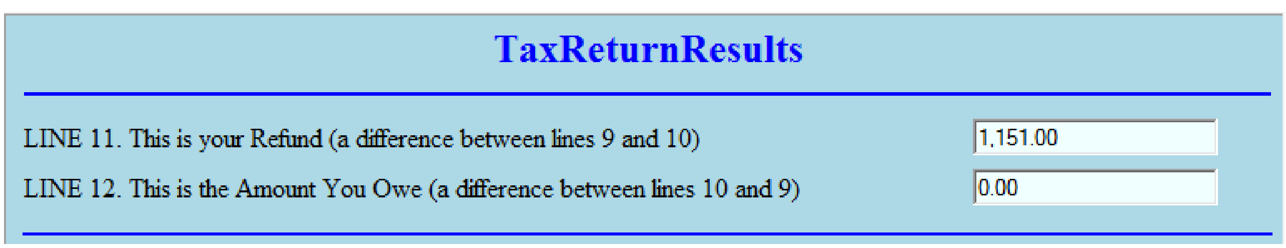
▶ b Routing number ▶ c Type: Checking Savings

▶ d Account number

Amount you owe

12 If line 10 is larger than line 9, subtract line 9 from line 10. This is the **amount you owe.** For details on how to pay, see page 20. ▶ 12

I'd put all these fields in one page like this one.



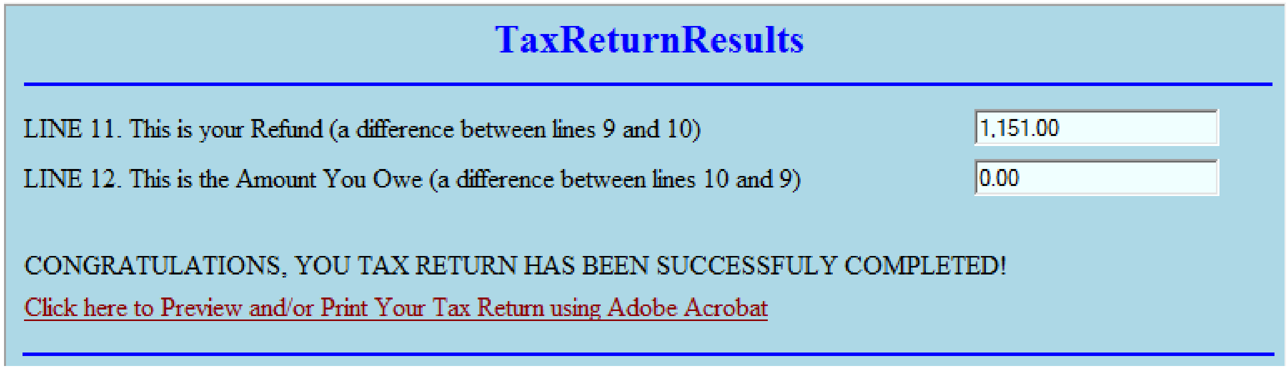
TaxReturnResults

LINE 11. This is your Refund (a difference between lines 9 and 10) — 1,151.00

LINE 12. This is the Amount You Owe (a difference between lines 10 and 9) — 0.00

Both Lines 11 and 12 will be calculated automatically.

OR. Let's add here two more fields to produce a "congratulation" message and a hyperlink to generate a final pdf document:



I think we created a nice yet simple design for our interactive questionnaire. It's time to implement it with OpenRules® Rules and Layout tables in Excel.

Implementing GUI Layouts

OR. ORD™ allows us to express the GUI in terms of "Pages" that can consist of multiple Sections that in turn can consist of various Questions. So, we will need to create 3 rules tables:

- pages
- sections
- questions

We will start defining pages, sections, and questions that are based on pre-defined templates.

Defining Pages

OR. Above you defined 5 pages:

- Taxpayer General Information
- Spouse Data
- Income Data
- Worksheet For Dependents
- Payment Data
- Tax Return Results.

I will put these 5 pages into the Rules table called "pages" created based on the template "pagesTemplate":

Rules pages extends pagesTemplate						
#	Page ID	Page Name	Hidden	Section Column 1	Section Column 2	Section Column 3
1	TaxpayerGeneralInformation	Taxpayer General Information		TaxpayerDataSection		
2	SpouseData	Spouse Data		SpouseGeneralInformation Section		
3	IncomeData	Income Data		IncomeDataSection		
4	WorksheetForDependents	Worksheet For Dependents		WorksheetForDependents Section		
5	PaymentData	Payment Data		PaymentDataSection		
6	TaxReturnResults	TaxReturnResults		TaxReturnResultSection		

Let me explain its structure. The first column contains page order number. The second column contains identifiers for all pages that should be expressed in one word. All page names should be unique. The third column provides titles of the proper pages as they will be displayed on the GUI. The fourth column allows us to hide certain pages from the initial navigation so they can be shown only under certain conditions from previous pages. We do not have this logic in our simple GUI, so all columns are empty. The fifth column lists all sections within pages. In our case each page has only one section, but this structure allows us to define several sections per page and to place them vertically using sub-columns in the same column or horizontally using multiple section columns – see more details at http://openrules.com/pdf/OpenRulesDialog.pdf.

User. It is clear so far. Now we can probably define all sections in a similar manner.

Defining Sections

OR. Yes, and below is the Rules table “sections” created based on the pre-defined template “sectionsTemplate”. Note that I am using the same Section IDs that were specified above in the table “pages” – that’s why all sections IDs should be unique too. I merged multiple rows within the column “Section ID” to avoid repeating the same IDs for questions that belong to the same section. However, because OpenRules® does not allow us to use “merge” in the very first column, I added one additional column “#” with no merges – we may put there sequential numbers, but I left the column empty. We have only one section per page so I left the column “Section Name” empty – nothing will be displayed on the GUI as a section title – the page title will be used in our case. Also none of our sections have to be hidden. And finally in the next 3 columns we will define the questions inside the sections.

Rules sections extends sectionsTemplate						
#	Section ID	Section Name	Hidden	Question Column 1	Question Column 2	Question Column 3
	TaxpayerDataSection			YourFirstName		
				YourMiddleInitial		
				YourLastName		
				AddressLine1		
				AddressLine2		
				City		
				State		
				ZipCode		
				YourSSN		
				MarriedFillingJointly		
	SpouseGeneralInformationSection			SpouseFirstName	SpouseMiddleInitial	SpouseLastName
				SpouseSSN		
				SpouseClaimedAsDependent		
	IncomeDataSection			Wages		
				TaxableInterest		
				UnemploymentCompensation		
				AdjustedGrossIncome		
				ClaimedAsDependent		
				DependentAmount		
				TaxableIncome		
				EmptyQuestion	Update	
	WorksheetForDependentsSection			A		
				B		
				C		
				D		
				E		
				F		
				G		
	PaymentDataSection			TaxWithheld		
				EarnedIncomeCredit		
				TotalPayments		
				Tax	Update	
	TaxReturnResultSection			Refund		
				AmountYouOwe		
				EmptyQuestion		
				Congratulations		
				GeneratePDF		

Actually, question IDs will be defined in a separate table “questions” – they again should be unique and have only one word. We will use these “future” question IDs freely here to define how questions are located within their sections. If questions are placed one under another they will be presented on the GUI at the same vertical order. If they are placed in different columns of the same row, the proper questions will be displayed horizontally from left to right – see for example questions SpouseFirstName, SpouseMiddleName, and SpouseLastName.

Defining Questions

OR. The most important and most complex table is “questions”, that defines questions using multiple predefined question types. I will show you the entire Rules table “questions” and will provide necessary comments (see the next page).

The first column “Question ID” shows all unique questions IDs as they were defined in the table “sections” above. The next column “Question Name” defines a name of the question exactly in the way it will be displayed on the GUI. The third column “Question Type” allows you to choose a type such as TextBox or RadioButton from a dropdown list of pre-defined question types.

We are using the following question types:

- **TextBox** with sometimes specified Size that replaces the default size 20.
- **ComboBox** where choice will be defined in a separate table “answers”
- **RadioButton** for Yes/No questions
- **ReadOnly** for questions with automatically calculated answers
- **ActionButton** for our buttons “Update”
- **Message** to display a congratulation message with no input
- **Custom** a question for pdf generation whose implementation logic will be defined in a separate table
- **Empty** a question that sometimes serves to allocate space between other questions.

User. Apparently we have a lot of choices to represent standard question types and even to add my own types. I can see that some questions also can be initially hidden (not in our case). What about the column “Validation”?

Rules questions extends questionsTemplate					
Question Id	**Question Name**	**Question Type**	**Size**	**Hidden**	**Validation**
YourFirstName	First name:	TextBox	18		
YourMiddleInitial	Middle initial:	TextBox	2		
YourLastName	Last name:	TextBox	20		
AddressLine1	Address (number and street):	TextBox	60		
AddressLine2	Apartment:	TextBox	60		
City	City, town or post office:	TextBox			
State	State:	ComboBox			
ZipCode	Zip:	TextBox	9		
YourSSN	Your social security number:	TextBox			SSN
MarriedFillingJointly	Is this a joint return together with your spouse?	RadioButton			
SpouseFirstName	First name:	TextBox	18		
SpouseMiddleInitial	Middle initial:	TextBox	2		
SpouseLastName	Last name:	TextBox	20		
SpouseSSN	Spouse's social security number:	TextBox			SSN
SpouseClaimedAsDependent	Can somebody claim your spouse on their return?	RadioButton			
Wages	LINE 1. Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2	TextBox			Range 1000 100000000
TaxableInterest	LINE 2. Taxable interest. If the total is over $1,500, you can not use Form 1040EZ	TextBox			Range 0 100000000
UnemploymentCompensation	LINE 3. Unemployment compensation and Alaska Permanent Fund dividents	TextBox			Range 0 30000
AdjustedGrossIncome	LINE 4. Adjusted gross income (calculated as a sum of lines 1, 2, and 3)	ReadOnly			
ClaimedAsDependent	LINE 5. Can your parents (or somebody else) claim you on their return?	RadioButton			
DependentAmount	Dependent Amount:	ReadOnly			
Update	Update	ActionButton			
TaxableIncome	LINE 6. Taxable Income (calculated as a difference between Lines 5 and 4)	ReadOnly			
A	A. Amount, if any, from LINE 1 + $250.00	ReadOnly			
B	B. Minimum standard deduction	ReadOnly			
C	C. The larger of line A or line B	ReadOnly			
D	D. Maximum standard deduction: $4,750 if single, $9,500 if married filing jointly	ReadOnly			
E	E. The smaller of lines C or D. This is your standard deduction	ReadOnly			
F	F. Exemption amount: 0 - if single; 0 - if married filling jointly and both you and your spouse can be claimed as dependents; $3,050 - if married filling jointly and only one of you can be claimed as dependents	ReadOnly			
G	G. TOTAL (a sum of lines E and F)	ReadOnly			
TaxWithheld	LINE 7. Federal income tax withheld from box 2 of your Form(s) W-2	TextBox			Range 1 1000000
EarnedIncomeCredit	LINE 8. Earned income credit (EIC)	TextBox			Range 1 1000000
TotalPayments	LINE 9. Your total payments (a sum of lines 7 and 8)	ReadOnly			
Tax	LINE 10. Tax. Calculated using the amount on the Line 6 above and the tax table	ReadOnly			
Refund	LINE 11. This is your Refund (a difference between lines 9 and 10)	ReadOnly			
AmountYouOwe	LINE 12. This is the Amount You Owe (a difference between lines 10 and 9)	ReadOnly			
Congratulations	CONGRATULATIONS, YOU TAX RETURN HAS BEEN SUCCESSFULY COMPLETED!	Message			
GeneratePDF	Preview and/or Print Your Tax Return using Adobe Acrobat	Custom			
EmptyQuestion		Empty			

OR. This column "Validation" allows you to use the standard validation criteria such as "Range 0 30000" to say that only amount between 0 and 30000 can be accepted as an answer for the question "UnemploymentCompensation" or that the answer to the question "YourSSN" should have a valid format for Social Security Numbers. If these conditions are violated during the interaction, then the proper error message will be displayed on the GUI. There are many more input validation criteria available – see http://openrules.com/pdf/OpenRulesDialog.pdf.

Automatically Calculated Answers

OR. Answers to some questions could be automatically calculated based on the answers to other questions and possible other information (for example, data coming from a database).

The rules for such auto-responses should be placed in the table "***autoResponses***". For example, an answer to the question "AdjustedGrossIncome" can be calculated using the following formula.

```
{
 double wages = d.getDoubleAnswer("Wages");
 double taxableInterest = d.getDoubleAnswer("TaxableInterest");
 double unemploymentCompensation = d.getDoubleAnswer("UnemploymentCompensation");
 double answer = wages + taxableInterest + unemploymentCompensation;
 format(answer);
}
```

Here, first we get an answer to the question "Wages" as

```
double wages = d.getDoubleAnswer("Wages");
```

where "d" is a variable that represents the current dialog. Similarly we get answers for questions "TaxableInterest" and "UnempoymentCompensation". Then we simply summarize these 3 double values using the formula:

```
double answer = wages + taxableInterest + unemploymentCompensation;
```

User. It is quite intuitive.

OR. All automatically calculated answers for our dialog can be presented in the table "autoResponses" (see next two pages).

OR. I hope you see how the calculation rules described in the form 1040EZ are represented in these formulas. I hope it would not scare you if I were to tell you that these formulas are written in accordance with Java syntax. Here we expressed the rules in terms of answers to already defined questions.

User. Could you comment about how you calculatde "Tax" as defined in Line 10? It is supposed to be calculated based on a tax table.

OR. That's exactly what we did in this snippet

```
Double tax = defineTax(taxableIncome.marriedFillingJointly);
```

Rules autoResponses extends autoResponsesTemplate	
Question Id	**Auto Response**
AdjustedGrossIncome	{ double wages = d.getDoubleAnswer("Wages"); double taxableInterest = d.getDoubleAnswer("TaxableInterest"); double unemploymentCompensation = d.getDoubleAnswer("UnemploymentCompensation"); double answer = wages + taxableInterest + unemploymentCompensation; format(answer); }
A	{ double wages = d.getDoubleAnswer("Wages"); format(wages + 250); }
B	:= format(750)
C	{ double a = d.getDoubleAnswer("A"); out("A="+a); double b = d.getDoubleAnswer("B"); out("B="+b); format(Math.max(a,b)); }
D	{ double answer = 4750; Question marriedFillingJointly = d.getQuestion("MarriedFillingJointly"); if (marriedFillingJointly.isAnswerTrue()) answer = 9500; format(answer); }
E	{ double c1 = d.getDoubleAnswer("C"); out("C="+c1); double d1 = d.getDoubleAnswer("D"); out("D="+d1); format(Math.min(c1,d1)); }
F	{ double answer = 0; Question marriedFillingJointly = d.getQuestion("MarriedFillingJointly"); Question claimedAsDependent = d.getQuestion("ClaimedAsDependent"); Question spouseClaimedAsDependent = d.getQuestion("SpouseClaimedAsDependent"); if (marriedFillingJointly.isAnswerTrue()) { if (claimedAsDependent.isAnswerTrue() && spouseClaimedAsDependent.isAnswerTrue()) answer = 0; else answer = 3050; } format(answer); }
G	{ double e = d.getDoubleAnswer("E"); out("E="+e); double f = d.getDoubleAnswer("F"); format(e+f); }

DependentAmount	`{ double answer = d.getDoubleAnswer("G"); Question claimedAsDependent = d.getQuestion("ClaimedAsDependent"); if (claimedAsDependent.isAnswerFalse()) { answer = 7800; Question marriedFillingJointly = d.getQuestion("MarriedFillingJointly"); if (marriedFillingJointly.isAnswerTrue()) answer = 15600; } format(answer); }`
TaxableIncome	`{ double adjustedGrossIncome = d.getDoubleAnswer("AdjustedGrossIncome"); double dependentAmount = d.getDoubleAnswer("DependentAmount"); double answer = adjustedGrossIncome - dependentAmount; if (answer < 0) answer = 0; format(answer); }`
TotalPayments	`{ double taxWithheld = d.getDoubleAnswer("TaxWithheld"); double earnedIncomeCredit = d.getDoubleAnswer("EarnedIncomeCredit"); format( taxWithheld + earnedIncomeCredit); }`
Tax	`{ double taxableIncome = d.getDoubleAnswer("TaxableIncome"); boolean marriedFillingJointly = d.getQuestion("MarriedFillingJointly").isAnswerTrue(); Double tax = defineTax(taxableIncome,marriedFillingJointly); format(tax.doubleValue()); }`
Refund	`{ double totalPayments = d.getDoubleAnswer("TotalPayments"); double tax = d.getDoubleAnswer("Tax"); double refund = totalPayments - tax; if (refund < 0) refund = 0; format(refund); }`
AmountYouOwe	`{ double totalPayments = d.getDoubleAnswer("TotalPayments"); double tax = d.getDoubleAnswer("Tax"); double amountYouOwe = tax - totalPayments; if (amountYouOwe < 0) amountYouOwe = 0; format(amountYouOwe); }`

Here we call a tax table that is defined as the following rule table "defineTax"in the file 1040EZTaxTable.xls:

Rules Double **defineTax**(double taxableIncome, boolean marriedFillingJointly)			
C1	C2	A1	

taxableIncome >= min	taxableIncome < max	double tax = tax1;
		if (marriedFillingJointly)
		tax = tax2;
		return new Double(tax);	

double min	double max	double tax1	double tax2
Taxable Income At Least	**Taxable Income Less Than**	**Tax if Single**	**Tax if Married filing jointly**
0	5	0	0
5	15	1	1
15	25	2	2
25	50	4	4
50	75	6	6
...	...	...	...

Possible Answers

OR. It would be convenient to define default answers to some questions (i.e. for the demonstration purposes) and also to specify choices for multi-choice questions.

First, we may define possible answers for our multiple-choice questions such as "State" or "ClaimedAsDependent" in a special Data table called "possibleAnswers".

Data PossibleAnswers possibleAnswers	
id	choices
ID	**Answers**
yesno	Yes
	No
USstates	AL
	AK
	AR
	AZ
	CA
	CO
	...

Then we may define a Data table "answers" that specifies default and possible answers for our entire 1040EZ dialog.

Data Answers answers		
Question Id	Default Answer	Possible Answers
YourFirstName	John	
YourMiddleInitial	N.	
YourLastName	Smith	
AddressLine1	25 Maple Street	
AddressLine2	Apt. 3C	
City	Edison	
State	NJ	USstates
ZipCode	08840	
YourSSN	164-86-2298	
MarriedFillingJointly	No	yesno
SpouseFirstName	Mary	
SpouseMiddleInitial	A.	
SpouseLastName	Smith	
SpouseSSN	164-78-0912	
SpouseClaimedAsDependent	No	yesno
ClaimedAsDependent	No	yesno
Income	100000	
DependentAmount	0	
Wages	32026	
TaxableInterest	1450	
UnemploymentCompensation	0	
AdjustedGrossIncome	0	
TaxableIncome	0	
A	0	
B	0	
C	0	
D	0	
E	0	
F	0	
G	0	
TaxWithheld	4530	
EarnedIncomeCredit	230	
TotalPayments	0	
Tax	0	

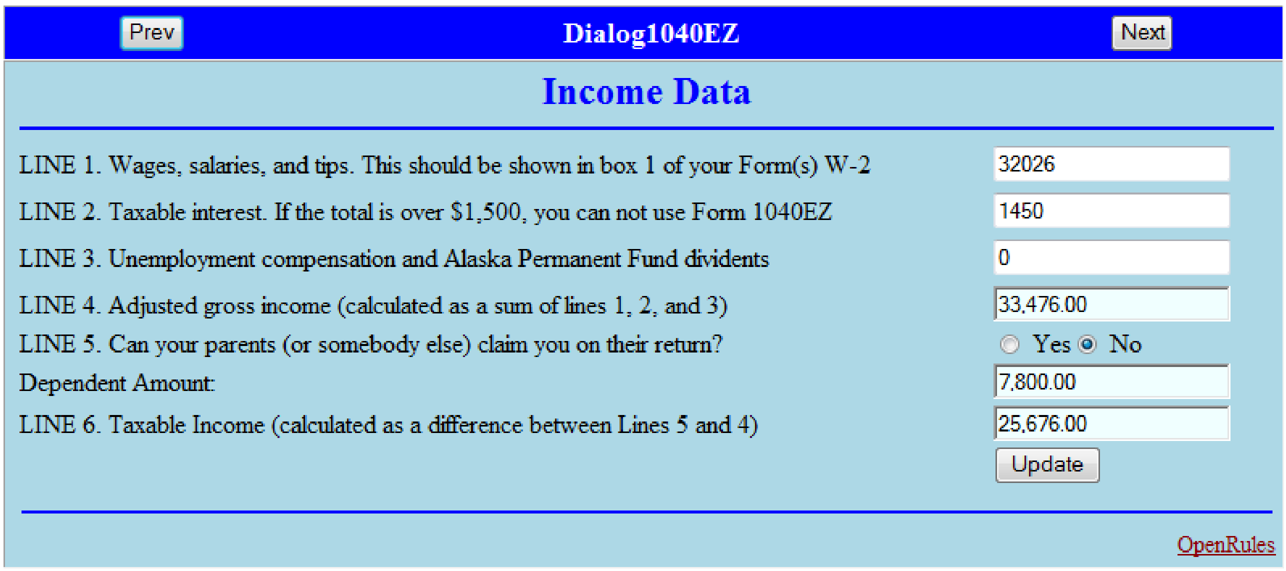
The first column refers to question IDs. The second column simply lists values that will be used as initial answers to those questions. And finally the third column provides possible answers for our multi-choice questions using already defined lists “yesno” and “USstates” – for complete tables look at the Excel file “Rules.xls”.

Dialog Navigation

OR. Now that we have almost all our pages with sections and questions defined, let’s think about how our user will navigate through these pages.

User. We could add buttons “Next” and Previous” to each page.

OR. Or we may add a menu or tabs for different page names. While ORD™ does provide templates for all these navigation mechanisms, let’s stick to your suggestion and add two buttons “Next” and “Prev” to the top of every page. For example, our Income Data page may look like below.



This page is created based on the simplest template, in which each page has 3 parts:

- Header
- Current Layout
- Footer.

For example, here is the standard header:

Layout TableLayout mainTitleBar(String dialogName)		
actionButton("Prev")	<td style="color:white;font-size:medium;font-weight:bold"> <C> dialogName </C> </td>	actionButton("Next")

This layout uses standard action buttons and a snippet of the HTML code to represent a dialog name. And here is the standard footer:

Layout TableLayout footerLayout()	
<i><C> dialog().status </C> </i>	<a href="http://openrules.com"> OpenRules

This footer along with a hyperlink to http://openrules.com, also contains a place where different status messages can be placed.

User. OK, this is just an external representation of buttons, etc. But how can we specify what the dialog should do when our user clicks on these buttons?

OR. In general you do not have to do anything. It is assumed that a user is always on some page starting with the first one listed in the table "pages". Every time that a user clicks "Next", the next page from the table "pages" will be displayed. And similarly, when a user clicks "Prev", the previous page from the table "pages" will be displayed.

User. But it will not work for us. For example, from the first page "TaxpayerGeneralInformation" we can go to the page "SpouseData" when MarriedFillingJointly is Yes, but we also may skip the SpouseData and go directly to the page "IncomeData" when MarriedFillingJointly is No.

OR. You are right, the navigation logic can be quite tricky, to represent it we should define a special rules table called "navigationRules". You always can create your own table based on the provided template "navigateDialogTemplate". To simplify our work, here is a completed table for our scenario:

Rules navigateRules extends navigateDialogTemplate							
C1	C2	C3			C4	A1	A4
IF Current Page is	AND Action is	AND			AND Condition is true	THEN Go to Page	AND Set Dialog Status
		Answer to Question	Is or IsNot	Value			
TaxpayerGeneralInformation	Next	MarriedFillingJointly	IsNot	Yes		IncomeData	
IncomeData	Prev	MarriedFillingJointly	IsNot	Yes		TaxpayerGeneral Information	
IncomeData	Next				{ double income = d.getDoubleAnswer("TaxableIncome"); income >=50000; }	IncomeData	SORRY, YOU CAN NOT USE 1040EZ FORM (your taxable income should be less than $50,000)
IncomeData	Next				{ double interest = d.getDoubleAnswer("TaxableInterest"); interest >= 1500; }	IncomeData	SORRY, YOU CAN NOT USE 1040EZ FORM (your taxable interest > $1,500)

As you can see, our table has 4 conditions C1, C2, C3, and C4 that together define different states of our dialog. Two actions A1 and A4 define the next page that should be shown when the proper conditions are satisfied and a dialog status to be displayed in the footer. This is a multi-hit rules tables meaning that all rows in this tables are ordered and next rows may override previous rows.

User. Why does it not show conditions for when MarriedFillingJointly is Yes and we should go to the page "SpouseData"?

OR. Because of the default rule - the page “SpouseData” goes right after the page “TaxpayerGeneralInformation” in our table “pages”. It means this rules is already defined. Obviously, you can define it again, but it is much easier to define only exceptions that violate the default order of pages. Thus, the very first rules will skip “SpouseData” when MarriedFillingJointly Is Not Yes. Similarly, the second rule will bring us back to the first page from the “IncomeData” when a user clicks “Prev” and MarriedFillingJointly Is Not Yes.

User. I see. And the third rule… Aha, it will keep us on the page IncomeData if the TaxableIncome >= 50,000.

OR. You are right. It will also display the warning “SORRY, YOU CAN NOT USE 1040EZ FORM (your taxable income should be less than $50,000)” in the status bar and would not allow a user to proceed with the Form 1040EZ.

User. And the fourth rules will do a similar thing when the TaxableInterest > 1,500. Nice! How about our Update buttons? Do you have a special table for them too?

OR. Yes, you are right again. There is a special rules table that modifies the state of the page itself by hiding/showing different questions and even sections based on answers to certain questions entered on the same page. However, in our case the buttons “Update” on the pages “IncomeData” and “PaymentData” should only recalculate answers to the proper read-only questions. But ORD™ always does such recalculation when you click any “submit” button. Because there are no navigation actions associated with the buttons “Update” our user will simply remain on the same page bur all read-only questions on this page will be automatically recalculated.

User. Wow, it seems quite intuitive. What else should we do? I am eager to see this dialog in work.

OR. Actually the only step remaining is to define a question “GeneratePDF” that is a custom hyperlink. But I think it would be simple enough to understand how it works directly from the Excel tables “customQuestions” and “makePDFHref” defined in the file “Rules.xls”. So, I will omit this part and will explain to you how to deploy our web questionnaire.

Web Server Deployment

User. I guess we will need some special web server to do that.

OR. ORD™ allows you to use any standard web servers such as commercial products the IBM WebSphere and the Oracle WebLogic or the open source Apache Tomcat server. We will use the Tomcat that can be easily downloaded and installed from http://tomcat.apache.org/. Actually, ORD™ provides you with a configuration file "build.properties" that defines where you installed your Tomcat. Then you simply double-click to the batch-file "deploy.bat" that copies your OpenRules web project to the Tomcat's webapps directory. That completes the deployment. Let me do it now from the provided project "Dialog1040EZ".

User. When I make changes in our Excel files, I should probably double-click on the "deploy.bat" again.

OR. Correct. To run our web application we need to start Tomcat (using a standard shortcut) and then from any Internet browser to enter URL `http://localhost:8080/Dialog1040EZ?name=Dialog1040EZ`. Or you may simply double-click on the convenience file "run.html" included in the project "Dialog1040EZ". Hope you like the results.

User. Thank you. I like the fact that I did not have to think about objects or deal with a glossary. We managed to express all our presentation, navigation, and business logic using only questions, sections, and pages. And it was quite intuitive. Thank you.

OR. You are welcome. The project Dialog1040EZ is included in the standard complete OpenRules® installation. For our convenience, here are the links to the Excel files that describe our questionnaire: Main.xls, Rules.xls, and 1040EZTaxTable.xls.

Appendix. Form 1040EZ

Form **1040EZ**

Department of the Treasury—Internal Revenue Service

Income Tax Return for Single and Joint Filers With No Dependents (99) **2003**

OMB No. 1545-0675

Label (See page 12.) **Use the IRS label.** Otherwise, please print or type.

LABEL HERE

Your first name and initial | Last name | Your social security number

If a joint return, spouse's first name and initial | Last name | Spouse's social security number

Home address (number and street). If you have a P.O. box, see page 12. | Apt. no.

City, town or post office, state, and ZIP code. If you have a foreign address, see page 12.

▲ Important! ▲ You **must** enter your SSN(s) above.

Presidential Election Campaign (page 12)

Note. Checking "Yes" will not change your tax or reduce your refund.
Do you, or your spouse if a joint return, want $3 to go to this fund? ▶

You: ☐ Yes ☐ No — Spouse: ☐ Yes ☐ No

Income

Attach Form(s) W-2 here. Enclose, but do not attach, any payment.

1	Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2. Attach your Form(s) W-2.	1	
2	Taxable interest. If the total is over $1,500, you cannot use Form 1040EZ.	2	
3	Unemployment compensation and Alaska Permanent Fund dividends (see page 14).	3	
4	Add lines 1, 2, and 3. This is your **adjusted gross income.**	4	
5	Can your parents (or someone else) claim you on their return? **Yes.** Enter amount from worksheet on back. ☐ **No.** If **single,** enter $7,800. If **married filing jointly,** enter $15,600. See back for explanation. ☐	5	
6	Subtract line 5 from line 4. If line 5 is larger than line 4, enter -0-. This is your **taxable income.** ▶	6	

Note. You **must** check Yes or No.

Payments and tax

7	Federal income tax withheld from box 2 of your Form(s) W-2.	7	
8	**Earned income credit (EIC).**	8	
9	Add lines 7 and 8. These are your **total payments.** ▶	9	
10	**Tax.** Use the amount on **line 6 above** to find your tax in the tax table on pages 24–28 of the booklet. Then, enter the tax from the table on this line.	10	

Refund

Have it directly deposited! See page 19 and fill in 11b, 11c, and 11d.

11a	If line 9 is larger than line 10, subtract line 10 from line 9. This is your **refund.** ▶	11a	
▶ b	Routing number ☐☐☐☐☐☐☐☐☐ ▶ c Type: ☐ Checking ☐ Savings		
▶ d	Account number ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐		

Amount you owe

12	If line 10 is larger than line 9, subtract line 9 from line 10. This is the **amount you owe.** For details on how to pay, see page 20. ▶	12	

Third party designee

Do you want to allow another person to discuss this return with the IRS (see page 20)? ☐ Yes. Complete the following. ☐ No

Designee's name ▶ | Phone no. ▶ ( ) | Personal identification number (PIN) ▶

Sign here

Joint return? See page 11. Keep a copy for your records.

Under penalties of perjury, I declare that I have examined this return, and to the best of my knowledge and belief, it is true, correct, and accurately lists all amounts and sources of income I received during the tax year. Declaration of preparer (other than the taxpayer) is based on all information of which the preparer has any knowledge.

Your signature | Date | Your occupation | Daytime phone number ( )

Spouse's signature. If a joint return, both must sign. | Date | Spouse's occupation

Paid preparer's use only

Preparer's signature ▶ | Date | Check if self-employed ☐ | Preparer's SSN or PTIN

Firm's name (or yours if self-employed), address, and ZIP code ▶ | EIN | Phone no. ( )

For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see page 23. Cat. No. 11329W Form **1040EZ** (2003)

Use this form if

- Your filing status is single or married filing jointly.
- You (and your spouse if married filing jointly) were under age 65 and not blind at the end of 2003. If you were born on January 1, 1939, you are considered to be age 65 at the end of 2003.
- You do not claim any dependents.
- Your taxable income (line 6) is less than $50,000.
- You do not claim a deduction for educator expenses, the student loan interest deduction, or the tuition and fees deduction.
- You do not claim an education credit, the retirement savings contributions credit, or the health coverage tax credit.
- You had **only** wages, salaries, tips, taxable scholarship or fellowship grants, unemployment compensation, or Alaska Permanent Fund dividends, and your taxable interest was not over $1,500. **But** if you earned tips, including allocated tips, that are not included in box 5 and box 7 of your W-2, you may not be able to use Form 1040EZ (see page 13). If you are planning to use Form 1040EZ for a child who received Alaska Permanent Fund dividends, see page 14.
- You did not receive any advance earned income credit payments.

If you are not sure about your filing status, see page 11. If you have questions about dependents, use TeleTax topic 354 (see page 6). If you **cannot use this form,** use TeleTax topic 352 (see page 6).

Filling in your return

For tips on how to avoid common mistakes, see page 21.

If you received a scholarship or fellowship grant or tax-exempt interest income, such as on municipal bonds, see the booklet before filling in the form. Also, see the booklet if you received a Form 1099-INT showing Federal income tax withheld or if Federal income tax was withheld from your unemployment compensation or Alaska Permanent Fund dividends.

Remember, you must report all wages, salaries, and tips even if you do not get a Form W-2 from your employer. You must also report all your taxable interest, including interest from banks, savings and loans, credit unions, etc., even if you do not get a Form 1099-INT.

Worksheet for dependents who checked "Yes" on line 5

(keep a copy for your records)

Use this worksheet to figure the amount to enter on line 5 if someone can claim you (or your spouse if married filing jointly) as a dependent, even if that person chooses not to do so. To find out if someone can claim you as a dependent, use TeleTax topic 354 (see page 6).

A. Amount, if any, from line 1 on front ______
+ 250.00 Enter total ▶ **A.** ______

B. Minimum standard deduction . . . . **B.** 750.00

C. Enter the **larger** of line A or line B here . . . . **C.** ______

D. Maximum standard deduction. If **single,** enter $4,750; if **married filing jointly,** enter $9,500 . . . . **D.** ______

E. Enter the **smaller** of line C or line D here. This is your standard deduction . . . . **E.** ______

F. Exemption amount.
- If single, enter -0-.
- If married filing jointly and—
  —both you and your spouse can be claimed as dependents, enter -0-.
  —only one of you can be claimed as a dependent, enter $3,050.

F. ______

G. Add lines E and F. Enter the total here and on line 5 on the front . . **G.** ______

If you checked "No" on line 5 because no one can claim you (or your spouse if married filing jointly) as a dependent, enter on line 5 the amount shown below that applies to you.

- Single, enter $7,800. This is the total of your standard deduction ($4,750) and your exemption ($3,050).
- Married filing jointly, enter $15,600. This is the total of your standard deduction ($9,500), your exemption ($3,050), and your spouse's exemption ($3,050).

Mailing return

Mail your return by **April 15, 2004.** Use the envelope that came with your booklet. If you do not have that envelope or if you moved during the year, see the back cover for the address to use.