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TEAM 20
OPERATION: IMPOSSIBLE

April 26, 2010

Model the Otherwise "Impossible"

So… he lied…

- Robert Irvine, chef and host of Dinner: Impossible, is fired from Food Network.

- **Dinner: Impossible** is a reality show that requires its host to prepare a multi-course meal for a large number of people in a limited time using limited ingredients.

Bad bad Robert Irvine

Food Network needs a replacement

MBAs see bleak job landscape in the recession
'The pay scales aren't there and even the jobs aren't there,' says one

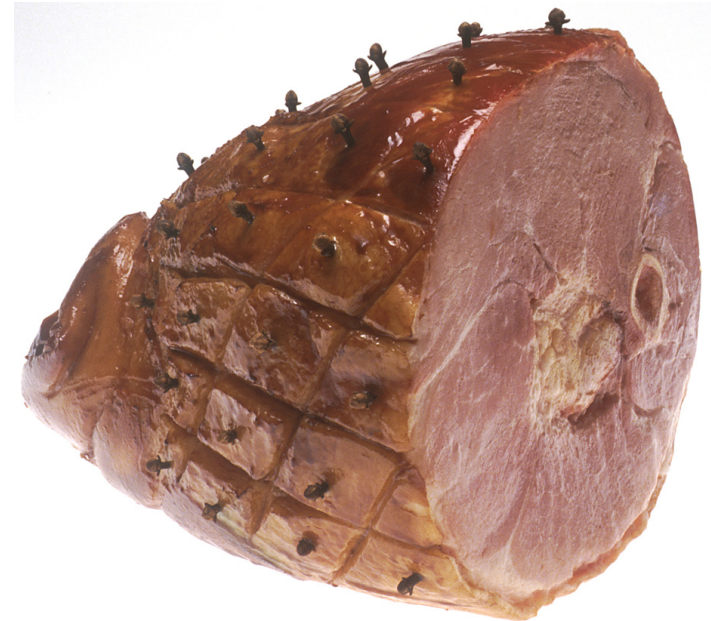Arrogant MBAs, Is an MBA Worth It, Jobs in the Down Economy

MBA Job Outlook Dims
New research suggests fewer companies will be hiring MBAs this year, and salaries in tech, financing, and manufacturing will be flat or down

Food Network wants YOU

But you have the culinary skills of a piece of ham

Food Network STILL wants you

Decision Models

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You have an epiphany

Oh yes, you DID

The mission you've been forced to accept

- Build a model that allows you to **plan a menu,** subject to the following constraints:
  - Number of guests to be served
  - Number of courses
  - Ingredients available
  - Human skill available
  - Kitchen appliances available

All while maximizing overall satisfaction of guests

Recipe book specifies ingredients required for each recipe

Recipe No.	Recipe Name	Serving Size	Protein				Starch		
			Chicken (lbs.)	Beef (lbs.)	Pork (lbs.)	Fish (lbs.)	Rice (cups)	Potatoes (lbs.)	Sweet
1	Agnolotti with Meat and Spinach Filling	8	0.5	0.5	0.5	0	0	0	
2	Apple Treacle Tart	10	0	0	0	0	0	0	
3	Banana Orange Crepes	1	0	0	0	0	0	0	
4	Beef Braised in Red Wine	4	0	3.5	0	0	0	0	
5	Caviar and Salmon Blini Tortes	2	0	0	0	0.25	0	0	
6	Chicken and Biscuits	6	3	0	0	0	0	0	
7	Chocolate Cake with Caramel-Milk Chocolate Frosting	12	0	0	0	0	0	0	
8	Coconut Tres Leches Cake with Caramelized Bananas	16	0	0	0	0	0	0	
9	Crostini with Beef Tartare and White Truffle Oil	4	0	1	0	0	0	0	
10	Grilled Breaded Pork Chops	8	0	0	4.5	0	0	0	
11	Grilled Indian-Spiced Butter Chicken	4	3.5	0	0	0	1.5	0	
12	Grilled Salmon with Lime Butter Sauce	6	0	0	0	3	0	0	
13	Herb-Basted Chicken with Bacon and Root Vegetable Pilaf	4	3	0	0.5	0	1	0.5	
14	Pasta with Kielbasa and Swiss Chard	4	0	0	0.5	0	0	0	
15	Pork Chops with Apples	4	0	0	3	0	0	0	
16	Risotto with Sweet Potato and Pancetta	6	0	0	0.5	0	2	0	
17	Roasted Spiced Chicken with Honey-Glazed Sweet Potatoes	4	2.25	0	0	0	0	0	
18	Sage-Roasted Chicken with Madeira Sauce	4	2.5	0	0	0	0	0	
19	Salmon Cakes with Garlic-Spinach Sauté	4	0	0	0	1	4	0	
20	Salmon Cannelloni with Lemon Cream Sauce	6	0	0	0	2	0	0	
21	Sausage and Bell Pepper Meatloaf	6	0	2	0	0	0	0	
22	Shredded Pork with Roasted Tomatoes and Chipotle Chiles	8	0	0	1.5	0	0	0	
23	Spaghetti Carbonara with Pork Belly and Fresh Peas	5	0	0	1	0	0	0	
24	Spanish-Style Chicken with Saffron Rice (Arroz con Pollo)	4	4	0	0	0	1.25	0	
25	Whole-Wheat Linguine with Spinach, Pancetta, and Parmesan	4	0	0	0	0	0	0	

Resources required for each recipe are also specified

Recipe Name	Skill (mins.)	
	Sous Chef	Head Chef
Agnolotti with Meat and Spinach Filling	70	10
Apple Treacle Tart	30	5
Banana Orange Crepes	30	15
Beef Braised in Red Wine	40	10
Caviar and Salmon Blini Tortes	80	20
Chicken and Biscuits	20	5

Recipe No.	Recipe Name	Appliance Time (mins.)	
		Stove	Oven
1	Agnolotti with Meat and Spinach Filling	20	0
2	Apple Treacle Tart	10	45
3	Banana Orange Crepes	255	0
4	Beef Braised in Red Wine	0	150
5	Caviar and Salmon Blini Tortes	20	0
6	Chicken and Biscuits	30	50

Satisfaction is captured as a utility function

Utility from 1 (least preferred) to 10 (most preferred)		
Recipe No.	**Recipe Name**	**Utility**
1	Agnolotti with Meat and Spinach Filling	10
2	Apple Treacle Tart	8
3	Banana Orange Crepes	6
4	Beef Braised in Red Wine	6
5	Caviar and Salmon Blini Tortes	9
6	Chicken and Biscuits	8
7	Chocolate Cake with Caramel-Milk Chocolate Frosting	7
8	Coconut Tres Leches Cake with Caramelized Bananas	10
9	Crostini with Beef Tartare and White Truffle Oil	9
10	Grilled Breaded Pork Chops	5
11	Grilled Indian-Spiced Butter Chicken	6
12	Grilled Salmon with Lime Butter Sauce	5
13	Herb-Basted Chicken with Bacon and Root Vegetable Pilaf	5
14	Pasta with Kielbasa and Swiss Chard	6
15	Pork Chops with Apples	5
16	Risotto with Sweet Potato and Pancetta	7
17	Roasted Spiced Chicken with Cinnamon- and Honey-Glazed Sweet Potatoes	8
18	Sage-Roasted Chicken with Madeira Sauce	8
19	Salmon Cakes with Garlic-Spinach Sauté	7
20	Salmon Cannelloni with Lemon Cream Sauce	9
21	Sausage and Bell Pepper Meatloaf	5
22	Shredded Pork with Roasted Tomatoes and Chipotle Chiles	8
23	Spaghetti Carbonara with Pork Belly and Fresh Peas	8
24	Spanish-Style Chicken with Saffron Rice (Arroz con Pollo)	9
25	Whole-Wheat Linguine with Spinach, Pancetta, and Parmesan	7

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Inputs are solicited from the D:I client

General Inputs				Pantry		
Name	**Value**	**Unit**		**Ingredient**		**Amount**	**Unit**
Number of people	100	person		Protein	Chicken (lbs.)	100	lbs.
					Beef (lbs.)	50	lbs.
Number of appetizers	2	per person			Pork (lbs.)	100	lbs.
Number of entrées	1	per person			Fish (lbs.)	60	lbs.
Number of desserts	1	per person		Starch	Rice (cups)	100	cups
					Potatoes (lbs.)	100	lbs.
Number of hours	2				Sweet Potatoes (lbs.)	40	lbs.
					Pasta (lbs.)	50	lbs.
Number of head chefs	1			Vegetables	Onion (nos.)	100	nos.
Number of sous chefs	2				Bell peppers (nos.)	25	nos.
					Carrots (nos.)	100	nos.
Number of stoves	1				Spinach (lbs.)	55	lbs.
Number of burners	4	per stove			Peas (cups)	50	cups
Number of ovens	1				Tomatoes (lbs.)	100	lbs.
				Baking	Wine (cups)	40	cups
					Flour (cups)	100	cups
					Butter (tbps)	100	tbsp
					Milk (cups)	50	cups
				Fruits	Apples (nos.)	100	nos.
					Bananas (nos.)	200	nos.

Everything goes into the mixing bowl

Recipe No.	Recipe Name	Yes/No	Utility	Type			Chicken	Beef	Pork	Fish	Rice	Potatoes	Sweet Potatoes	Pasta	Onion
				Appetizer	Entrée	Dessert									
1	Agnolotti with Meat and Spinach Filling	0	10	1	0	0	6.25	6.25	6.25	0	0	0	0	0	6.25
2	Apple Treacle Tart	0	8	0	0	1	0	0	0	0	0	0	0	0	0
3	Banana Orange Crepes	1	6	0	0	1	0	0	0	0	0	0	0	0	0
4	Beef Braised in Red Wine	0	6	0	1	0	0	43.75	0	0	0	0	0	0	12.5
5	Caviar and Salmon Blini Tortes	1	9	1	0	0	0	0	0	3.125	0	0	0	0	3.125
6	Chicken and Biscuits	0	8	0	1	0	37.5	0	0	0	0	0	0	0	12.5
7	Chocolate Cake with Caramel-Milk Chocolate Frosting	0	7	0	0	1	0	0	0	0	0	0	0	0	0
8	Coconut Tres Leches Cake with Caramelized Bananas	0	10	0	0	1	0	0	0	0	0	0	0	0	0
9	Crostini with Beef Tartare and White Truffle Oil	1	9	1	0	0	0	12.5	0	0	0	0	0	0	6.25
10	Grilled Breaded Pork Chops	0	5	0	1	0	0	0	56.25	0	0	0	0	0	0
11	Grilled Indian-Spiced Butter Chicken	0	6	0	1	0	43.75	0	0	0	18.75	0	0	0	25
12	Grilled Salmon with Lime Butter Sauce	0	5	0	1	0	0	0	0	37.5	0	0	0	0	0
13	Herb-Basted Chicken with Bacon and Root Vegetable Pilaf	0	5	0	1	0	37.5	0	6.25	0	12.5	6.25	0	0	12.5
14	Pasta with Kielbasa and Swiss Chard	0	6	1	0	0	0	0	6.25	0	0	0	0	9.375	0
15	Pork Chops with Apples	0	5	0	1	0	0	0	37.5	0	0	0	12.5	0	12.5
16	Risotto with Sweet Potato and Pancetta	0	7	1	0	0	0	0	6.25	0	25	0	12.5	0	12.5
17	Roasted Spiced Chicken with Cinnamon- and Honey-Glazed Sweet Potatoes	0	8	0	1	0	28.125	0	0	0	0	0	25	0	0
18	Sage-Roasted Chicken with Madeira Sauce	0	8	0	1	0	31.25	0	0	0	0	0	0	0	12.5
19	Salmon Cakes with Garlic-Spinach Sauté	0	7	0	1	0	0	0	0	12.5	50	0	0	0	6.25
20	Salmon Cannelloni with Lemon Cream Sauce	0	9	0	1	0	0	0	0	25	0	0	0	25	12.5
21	Sausage and Bell Pepper Meatloaf	0	5	0	1	0	0	25	0	0	0	0	0	0	37.5
22	Shredded Pork with Roasted Tomatoes and Chipotle Chiles	0	8	1	0	0	0	0	18.75	0	0	0	0	0	9.375
23	Spaghetti Carbonara with Pork Belly and Fresh Peas	0	8	0	1	0	0	0	12.5	0	0	0	0	12.5	6.25
24	Spanish-Style Chicken with Saffron Rice (Arroz con Pollo)	1	9	0	1	0	50	0	0	0	15.625	0	0	0	12.5
25	Whole-Wheat Linguine with Spinach, Pancetta, and Parmesan	0	7	0	1	0	0	0	0	0	0	0	0	12.5	0
				2	1	1	50	12.5	0	3.125	15.625	0	0	0	21.875
				=	=	=	<=	<=	<=	<=	<=	<=	<=	<=	<=
		Total utility	33	2	1	1	100	50	100	60	100	100	40	50	100

=SUMPRODUCT($B$2:$B$26,F2:F26)   =IF(VLOOKUP($A27,'Recipe Type'!$A$1:$C$26,3,0)=3,1,0)   =SUMPRODUCT($B$2:$B$26,P2:P26)

Binary decision variables

Utility function

Course constraints

Ingredient constraints

Decision Models

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A switch is flipped

Solver Parameters

Set Target Cell: $C$30

Equal To: ● Max ○ Min ○ Value Of: 0

By Changing Cells:

$C$3:$C$27

Subject to the Constraints:

$C$3:$C$27 = binary
$G$28:$I$28 = $G$30:$I$30
$K$28:$AD$28 <= $K$30:$AD$30
$AF$28:$AG$28 <= $AF$30:$AG$30
$AI$28:$AJ$28 <= $AI$30:$AJ$30

Maximize utility function

Pick recipes

"Picked" binary constraint

Course constraint

Ingredient constraint

Skill constraint

Appliance usage constraint

Voila! A menu is selected

Recipe Name	Yes/No
Agnolotti with Meat and Spinach Filling	0
Apple Treacle Tart	0
Banana Orange Crepes	1
Beef Braised in Red Wine	0
Caviar and Salmon Blini Tortes	1
Chicken and Biscuits	0
Chocolate Cake with Caramel-Milk Chocolate Frosting	0
Coconut Tres Leches Cake with Caramelized Bananas	0
Crostini with Beef Tartare and White Truffle Oil	1
Grilled Breaded Pork Chops	0
Grilled Indian-Spiced Butter Chicken	0
Grilled Salmon with Lime Butter Sauce	0
Herb-Basted Chicken with Bacon and Root Vegetable Pilaf	0
Pasta with Kielbasa and Swiss Chard	0
Pork Chops with Apples	0
Risotto with Sweet Potato and Pancetta	0
Roasted Spiced Chicken with Cinnamon- and Honey-Glazed Sweet Potatoes	0
Sage-Roasted Chicken with Madeira Sauce	0
Salmon Cakes with Garlic-Spinach Sauté	0
Salmon Cannelloni with Lemon Cream Sauce	0
Sausage and Bell Pepper Meatloaf	0
Shredded Pork with Roasted Tomatoes and Chipotle Chiles	0
Spaghetti Carbonara with Pork Belly and Fresh Peas	0
Spanish-Style Chicken with Saffron Rice (Arroz con Pollo)	1
Whole-Wheat Linguine with Spinach, Pancetta, and Parmesan	0

Dessert: Banana Orange Crepes

First Appetizer: Caviar and Salmon Blini Tortes

Second Appetizer: Crostini with Beef Tartare and White Truffle Oil

Entrée: Arroz con Pollo

Decision Models

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This model can be improved

- Timing of use of scarce resources like the oven

- Accounting for special dietary needs

- Reduce wastage

- Addition of nutritional information

- Addition of recipes and ingredients

Juran said we "might" get an A

This model has alternate uses

- Selecting which daily specials to offer at a restaurant based on ingredients available

- Understand bottlenecks in terms of resources available and required in a restaurant

- Minor modifications can be made to convert this model into one that generates shopping lists

Good times

Elizabeth French
Ryan Hollar-Gregory
Zubin J. Dalal

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OPERATION: IMPOSSIBLE

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