Rockgym

**Sample Only**

This document was submitted by students in a previous class. Their requirements were different from yours. We offer it only as a sample of what a project was for that class. Copying this document, in whole or in part, and submitting the result as your own work, would be a violation of the honor code.

Reference Guide

Version 4.0

**1. How the calculation works**

The input parameters can be found on the Parameters sheet and the input streams can be found on the Inputs sheet of the workbook. The outputs can be located on four sheets of the workbook: Costs, Admissions, Income, and Expansion. In addition, there is a Summary sheet that contains the most important output streams. In order to get to the bottom line figures on the Expansion sheet and Summary sheet, which are cumulative profits after opening a new gym, you can follow the intermediary steps on the four output sheets. It is important to consider the impact of the inputs on income and costs besides finding the bottom line numbers. Below is an explanation of the numbers calculated on each of the output sheets, broken down by sheet.

*Costs sheet*:

The monthly fixed costs that the user entered on the Parameters tab appear in cells B5 through M12 month by month. In order to operate the rock gym, fixed costs that the owner will incur are utilities, maintenance, insurance, rent, miscellaneous expenses, employee wages, taxes, and upper management costs entered in lines 5 through 12 respectively.

Line 13: sums up the costs from lines 5 through 12 to find total fixed costs: Utilities+Maintenance+Insurance+Rent+Miscellaneous+Employees+Taxes+UpperManagement=Total Fixed Costs

In order to avoid possible user error, the costs mentioned above are entered as array formulas. The user cannot overwrite a single cell in B5 through M13 unless he/she makes the changes on the Parameters sheet. We used array formulas throughout the model to minimize the possibility of user error.

Variable Costs are calculated in cells B17 through M19. They consist of costs resulting from running radio and newspaper ads.

Line 17: uses the following array formula to calculate radio advertisement costs: RadioAds\*RadioAdCost. RadioAds is an input stream from line 5 of the Inputs tab and RadioAdCost is the monthly cost for running the ads, entered by the user on the Parameters sheet in cell B14.

Line 18: similarly to line 17, the formula for the cost associated with running newspaper ads is NewspaperAds\*NewspaperAdCost. NewspaperAds is an input stream from line 6 of the Inputs tab and NewspaperAdCost is the monthly cost for running the ads in the newspaper, entered by the user on the Parameters sheet in cell B15.

Line 19: uses the array formula RadioCosts+NewspaperCosts to get arrive at variable costs. Besides fixed costs, the owner will also incur variable costs which will depend on the extent of advertising that the owner plans of running each month.

Total Fixed Costs are calculated in Line 23: using the figures from line 13 and 19: TotalFixedCosts+TotalVariableCosts.

*Admissions* sheet:

This sheet calculates the net number of climbers by taking into consideration that some people quit each month and that the number of climbers increases as a result of advertisements. In order to find the effects of a series of advertisements, we used convolution.

The impact Radio and Newspaper ads have on admissions are located in rows 12-15 on the Inputs sheet. Each month’s impact for each type of advertising effect is independently adjustable. Cells B5 through M6 on the Admissions sheet convolve radio ads and the increase in climbers due to radio advertising separately for adults using the formula CONVOLVE(RadioAds,RadioImpactAdults), and for students using the formula CONVOLVE(RadioAds,RadioImpactStudents). Cells B10 through M11 mimic cells B5 through M6 for newspaper ads impacting adults using the formula CONVOLVE(NewspaperAds,NewspaperImpactAdults), and for students using the forumula CONVOLVE(NewspaperAds,NewspaperImpactStudents).

We were able to use convolution because by examining the effects of a series of advertising, there is a gradual change in the overall number of new climbers. In the few days right after advertising we might see a surge of new climbers and in the following months it will gradually decrease as the effects of advertising disappears. Convolution lets us find the time response or “temporal response” of a system as it responds to an input. Convolution is justified because the system is non-predictive, linear, and time-invariant. To compute the response of this system we convolved the input (advertisement) with the base response.

Once we knew the impact of advertising on adults and students, we could calculate the increases in admissions into the gym. The percentage increase of adult climbers is calculated with the array formula RadioNewAdultsPercentage+NewspaperNewAdultsPercentage while for students it was RadioNewStudentsPercentage+NewspaperNewStudentsPercentage. In line 17 and 18 we translated this to an increase in the number of adult and student climbers. For example, in January the number of adult climbers will be StartingAdultAdmissionsPerMonth\*the percentage increase in January. For months after January, the calculation is different. We still use the percentage increases for each month, but this time we multiply it by something different. Instead of StartingAdultAdmissionsPerMonth, we multiply the adult percentage increase by the previous month’s FinalAdultAdmissions (after ad increases and quits have been taken into account). For example, for the month of February, the increase in the number of adult climbers is the percentage increase for February (cell C15) times the FinalAdultAdmissions for January (cell B30). This process is the same for students, and it is repeated for every month besides January.

Cells B24 through C25 calculate how many climbers quit each month based on the quit rates entered by the user on the Parameters sheet. The net number of climbers each month can be seen in cells B29 through M30 of the Admissions sheet divided between adults and students.

*Income* *sheet*:

The Income sheet calculates the gym’s profits by subtracting total costs from total revenues. Revenues depend on the number of climbers each month calculated on the Admissions sheet and the admission prices charged that are set by the user on the Parameters sheet.

Line 5: revenues from adult climbers. FinalAdultAdmissions\*AdultPrice .

Line 6: revenues from student climbers. FinalStudentAdmissions\*StudentPrice for students.

Line 7: adding AdultRevenues and StudentRevenues as an array formula will result in total revenues.

Line 11: total costs are pulled directly from line 23 of the Costs sheet.

Line 15: to calculate monthly profits, subtract total costs from total revenues.

Line 16: apply the running sum formula for cumulative profits.

*Expansions* *sheet:*

The Expansions sheet shows the monthly profits per month calculated on the Income sheet, whether or not the gym owner planned to expand based on the entries on the Input sheet, and the expansion costs.

Line 5: pulls from line 15 of the Income sheet.

Line 6: is the input steam entered by the user in line 7 of the Inputs sheet and shows how many new locations the owner planned to open.

Line 7: calculates expansion costs with the help of an array formula, Expansions\*CostOfExpansion, using cells B7 through M7 of the Inputs sheet and cell B30 of the Parameters sheet, respectively.

Line 8: shows monthly profits after expansion that comes directly from line 15 of the Income sheet. The array formula is MonthlyProfitsBeforeExpansion-ExpansionCosts.

Line 9: shows cumulative profits after expansion using a running sum of the line above.

*Summary sheet:*

The Summary sheet simply presents a recap of the most important output streams of the model. Each of these streams is simply a replication of a line on one of the intermediate output streams pages, such as Costs or Admissions.

Line 5: pulls from line 23 of the Costs sheet.

Line 6: pulls from line 29 of the Admissions sheet.

Line 7: pulls from line 30 of the Admissions sheet.

Line 8: pulls from line 15 of the Income sheet.

Line 9: pulls from line 16 of the Income sheet.

Line 10: pulls from line 8 of the Expansions sheet.

Line 11: pulls from line 9 of the Expansions sheet.

**2.** **How to locate inputs, outputs and intermediate results**

All data that the user can modify is segregated. They can be found on the following two sheets: Parameters and Inputs. Colors play a role in the model.

*Green*: information that the user of the model may edit.

*Yellow*: calculated cells that are not used in the subsequent sheets. They show intermediary results.

*Blue*: calculated cells that are referred to on the next sheets. They show intermediary results.

*Orange*: the final output of the model that tells the user whether an expansion is affordable. This can be found on the Expansions sheet and the Summary sheet.

**3. Guide to visual cues and naming conventions**

The *sheet names* are all alphabetic characters starting with an upper case letter followed by lower case letters. The sheet names are ten characters long or fewer.

We used *global names* for our variables so that we can refer to them on any worksheet within the workbook.

The *parameter names* are in mixed case so that each word component of it starts with an upper case letter followed by lower case letters. Parameter names are located directly to the left of the cell they refer to and are right aligned.

*Range names* are also in mixed case and located to the left of the range they refer to and are right aligned.

*Row captions* are left justified while column headings are centered.

*Numeric data* are right aligned.

*Currency numbers* are formatted as numbers using 1000 separator (,) without decimals indicated.

*Non-currencies* are formatted as numbers without using the 1000 separator and no decimals are indicated. *Percentages* are formatted as 10% with no decimal place.

**4. How to make changes**

There are a few different ways you can adapt the model according to your purposes. You can change any of the input parameters, indicated in green on the Parameters tab. For example, if you want to see what impact an increase in admission price will have on the profits, you would overwrite cells B22 and B23. Or it might cost more money to open a new location in one part of the town than another. You can modify cell B30. Or to change monthly fixed costs, you would enter the appropriate numbers in cells B4 through B11.

Another part of the model that you can modify is the Inputs sheet. You can determine whether you plan to run any radio ads or newspaper ads and if so, in which month of the year. You can also decide how many new locations you plan to open in the upcoming year. Finally, you could change the impacts radio and newspaper ads have on students and adults. The green cells on either sheet may be modified freely and independently from one another.

If you feel very comfortable with the model and have experience with Excel as well as array formulas and the concept of convolution, further modification could be made, however there is a higher chance that an error will be made.

Let’s assume that the gym decides that it also wants to advertise on TV to attract even more climbers in order to boost revenues. Making a change like this sounds easy, however you will have to look at each sheet carefully to make sure you reflect the changes caused by adding a third source of advertisement. You will not only have to change the parameters and inputs marked in green, but you will also need to modify formulas on the output sheets.

*Parameters sheet*:

By adding TV ads, you will need to insert a line after line 15 on the Parameters sheet and enter the cost of TV advertising. Name cell B16 TVAdCost using a global variable. Make sure you are using a global variable so that you will be able to refer to the cell in the following sheets.

*Inputs sheet:*

You will need to insert a line between NewspaperAdds and Expansions on the Inputs sheet and name the range TVAds following the naming conventions described above. You would need to use a global name so that you will be able to refer to this range in other sheets of the workbook. You will then be required to follow this change through on subsequent sheets as well as carefully double-check and rewrite calculations.

You will also have to add two lines to the very bottom for TVImpactAdults and TVImpactStudents and fill in cells to reflect the impact on the increase of climbers as a result of running TV ads. Enter the appropriate percentages in cells B17 through M18. Name the ranges according to our naming conventions.

*Costs sheet*:

Insert a row after line 18 and name cells B19 through M19 TVCosts using a global name. The array formula to enter in cells B19 through M19 would be TVAds\*TVAdCost.

Change the array formula in cells B20 through M20 to read RadioCosts+NewspaperCosts+TVCosts.

Line 24 will show your new total costs including radio, newspaper and TV ads.

*Admissions sheet*:

Insert five new lines above Increases and similar to the Newspaper Advertising Impact, create a calculation for the TV Advertising Impact. Let’s say in line 15, in cells B15 through M15 you would enter =CONVOLVE(TVAds,TVImpactAdults). In the line below, you would enter =CONVOLVE(TVAds,TVImpactStudents). You would have to modify the formula for AdultIncreasePercentage and StudentIncreasePercentage to also include TVNewAdultsPercentage and TVNewStudentsPercentage respectively.

The rest of the calculations wouldn’t have to be changed and you could see the final result on the Expansions and Summary sheets. As you can see, adding a few input streams to the model could be rather tedious and prone to errors if you are not careful.