How to Run Mathematica Batch-files in Background?

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Contents

Preface 3

1 Introduction 4

2 How to Create a Mathematica Batch-file and Run it in Background 4

Concluding Remarks 7

Acknowledgment 7

References 7
Preface

Mathematica is a versatile equipment for doing numeric and symbolic computations and it has wide spread applications in all branches of science. Mathematica has a complete consistency to design it at every stage that gives it multilevel capability and helps advanced usage evolve naturally. Mathematica functions work for any precision of number and it can be easily computed with symbols, represented graphically to get the best answer. Mathematica is a robust software development that can be used in any popular operating systems and it can be communicated with external programs by using proper mathlink commands.

Sometimes it is quite desirable to run jobs in background of a computer which can take considerable amount of time to finish, and this allows us to do work on other tasks, while keeping the jobs running. Most of us are very familiar to run jobs in background for the programs written in the languages like C, C++, F77, F90, F95, etc. But the way of running jobs, written in a mathematica notebook, in background is quite different from the conventional method. In this article, we explore how to create a mathematica batch-file from a mathematica notebook and run it in background. Here we concentrate our study only for the Unix version, but one can run mathematica programs in background for the Windows version as well by using proper mathematica batch-file.
1 Introduction

Mathematica is the world’s best powerful computing system which has been released in 1988 and have profound evidences on the way of computations that are used in technical and other fields of work. The key intellectual aspect in mathematica is the invention of a new kind of symbolic computation language that can manipulate the very wide range of objects needed to achieve the generality required for technical computing by using a very small number of basic primitives. Mathematica has wide spread applications in every branch of sciences-physical, biological, social, and other and has played a crucial role in many important discoveries and has been basis for thousands of technical papers.

Mathematica is a versatile and powerful package for calculating mathematics and publishing mathematical results. It can be used in almost all popular workstation operating systems like, Microsoft Windows, Apple Macintosh operating system, Linux and other Unix-based systems. As a programming tool Mathematica [1] provides a rich set of programming extensions. Programming can be done in different ways like functional, logical i.e., rule-based or procedural type or a mixture of all these three. The another most important aspect is that, mathematica provides mathlink [2,3] which allows mathematica programs to communicate with external programs written in C, Java, XL-Fortran languages or any other languages. Mathematica is now emerging as an important tool in many branches of computing, and today it stands as the world’s best system for general computation.

In the previous article [3], we have studied in detail how to start mathematica, write programs in mathematica and the way of linking of external programs with a mathematica notebook by using proper mathlink commands. Now it is quite desirable to run jobs in background which take much time to finish and to do other works in separate windows, keeping the jobs running. This motivates us to explore the basic mechanisms for running mathematica programs in background. It can be done by creating proper mathematica batch-file which we will describe here elaborately, and this study may be quite helpful for us.

2 How to Create a Mathematica Batch-file and Run it in Background

In order to understand the complete process, let us start by giving a very simple example of a mathematica program. We set the program as follows:
The generation of a list of two random numbers, a 2D plot from these set of random numbers and then the creation of an ‘EPS’ file for this 2D plot.

For this program, first we need to make a list of two random numbers and then construct a 2D plot using this set of random numbers. Finally, we make an ‘EPS’ file for this plot. Our main aim of this article is to run this complete job in background. Before doing this job in background, let us now describe the different mathematical operations with proper commands which are to be done in a mathematica notebook for this particular job.

The program for the generation of a set of two random numbers and a 2D plot from these numbers is as follows:

```mathematica
sample[times_]:={
    local variables
}

numbers=Table[
    {Random[], Random[]},
    {i, 1, times}
]

fig=ListPlot[
    numbers,
    PlotJoined→True,
    AxesLabel→{xlabel, ylabel}
]
```

To get the output of this program, we run it by entering some value for the variable ‘times’, like ‘sample[100]’ or ‘sample[200]’ etc. Then the mathematica does the proper operations and executes the result in an output cell. The output of the 2D plot is shown in Fig. 1.

![Figure 1: A 2D plot for a set of two random numbers.](image)

Now to create an ‘EPS’ file for this 2D plot we use the following operation:

```mathematica
Export[“filename.eps”, fig, “EPS”]
```
In this above expression, the name ‘fig’ is used to call the graphics file, and the ‘eps’ file is saved by the name ‘filename.eps’ in the present working directory.

Thus we are now clear about all the mathematical operations those are to be done in a mathematica notebook for the above mentioned program. So now we make our attention for running this program in background.

In order to run this program in background, first we need to create a batch-file which is a text file from these mathematica input commands those are written in different cells of a mathematica notebook. For this purpose, we go through these steps:

(a) Select the cells from the mathematica notebook, and then follow the direction by clicking on Cell → Cell Properties → Initialization Cell from the menu bar to initialize the cells.

(b) To generate the batch-file, follow the direction by clicking on File → Save As Special... → Package Format from the menu bar.

Then a dialog box appears for specifying the file name and the location of the mathematica input file. Here we use the input file for the operation of the mathematica job.

After these steps, let us suppose, we generate a batch-file named as ‘santanu.m’ for the above mathematica program. Generally the batch-files for this purpose are specified by using the extension ‘.m’ i.e., like the name as ‘filename.m’. To run this batch-file ‘santanu.m’ in background, we use the following prescription:

```
nohup time math < santanu.m > santanu.out &
```

The file name ‘santanu.out’ is the output file, where all the outputs for the different operations are available. To get both the input and output lines of the mathematica notebook, it is necessary to use the following command in the first line of the notebook.

```
AppendTo[$Echo, "stdout"]
```

At the end of all these steps, we get the output file ‘santanu.out’ and the graphics file ‘filename.eps’ in ‘EPS’ format in the present working directory where the batch-file ‘santanu.m’ is run in the background.
Concluding Remarks

In summary, we have addressed in detail how to set up a mathematica batch-file from a mathematica notebook and run it in the background of a computer. Several programs are there which can take a considerable amount of time to run. Some may take few days or even few weeks to complete their analysis. For this reason, it may be desirable to place such jobs in the background. This is a way of running a program that allows one to continue working on other tasks (or even log out) while still keeping the program running. Furthermore, backgrounded jobs are not dependent on our session remaining open, so even if our computer crashes, the job will continue uninterrupted.

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