

Department of Physics and Astronomy

Grades Reporter

User's Guide

Fall 1994

DRAFT GUIDE

This is my first cut at a usable guide. The important stuff for you guys who want only to edit the database file and get out is the format of the database file in section V starting on page 8.

I. Overview

The Grades Reporter is a process by which students in a particular course may receive on demand a copy of their grades in each of the course's components, along with sufficient context to enable them to understand quantitatively how they are performing in the course.

The Grades Reporter should therefore reduce the number of questions regarding performance that the instructor needs to address.

The mechanism by which the grades are communicated to the student is electronic mail. The student sends mail to a defined address, and receives an automatic response within a few seconds. Naturally, this requires each student who wishes to receive a report of their grades to have an electronic mail address. Presently at USC this is allowed as a zero-cost option to each student registered in the University.

II. Security

The dissemination of student grade information entails the risk that a student's personal information will be released to an unauthorized individual, a risk which must be minimized. The approach which the Grades Reporter takes is to rely upon the security of each student's own electronic mail account. If the Grades Reporter receives mail from an account identified by the student's username, it assumes that it is, in fact, the student who sent the request. If that assumption is wrong, however, the responsibility for compromising the student's privacy rests with him or her.

The database containing all of the student records, as well as all associated files, must be available to every instructor participating in the course, as well as the Grades Reporter itself, but no one else. The mechanism by which this is achieved is the use of a special UNIX group, presently named *phys-gds*, which contains all current instructors of participating courses and a few support staff in the departmental office.

III. The Student's Perspective

A. Operation

Before receiving any report containing personal information, the student must inform the instructor of his/her valid username so that it may be entered into the database for identification.¹

In order to receive a copy of one's grade components, the student simply sends electronic mail to an address which is defined for the course. In the examples given here the address is "phys151grades." All addresses used by the Grades Reporter are within the usc.edu domain, and may be reached without appending any domain information. If a particular machine is appended to the defined address, mail first goes there before it is properly directed.

¹ This step is not a *necessary* one since it is possible to determine student usernames through USCInfo, which has now developed into a useful tool. However, this is usually more effort than to have the students give their usernames up front.

All mail fields are optional. No subject is required, nor is there any need for text. The Grades Reporter parses the mail header searching for the relevant information, and explicitly ignores everything after the header.

Within a few seconds of mailing the request, the student receives a report.

B. Format of the Report

A typical report which could have been delivered to a student at the end of the Fall 1993 semester is shown in Fig. 1. The important features are indicated in the figure.

Subject: If the student had no subject line in the requesting mail, then the subject is "Your Grades Reporter Request." If the student had a subject line, the subject of the return mail prepends "Re: " to the original subject. Higher orders of "Re: " are also indicated.

```
Subject: Your Grades Reporter Request

Welcome to the Department of Physics and Astronomy Grades Reporter.

The database for this report was last updated:
    Sat Apr 30 06:47:59 1994
```

Grade Component	Your Grade	Class Avg	Your Rank
Practice Midterm	--	100	none
Midterm 1	92	50	1/160
Midterm 2	58	46	38/148
HW 1	9.5	8.5	27/158
HW 2	8.5	8.3	70/149
HW 3	8.0	9.1	117/139
HW 4	6.5	7.7	96/132
HW 5	7.0	8.2	102/123
HW 6	8.8	7.8	28/125
HW 7	--	8.5	none
HW 8	4.0	8.1	105/108
HW 9	8.5	8.9	82/120
HW10	5.8	6.6	65/100
HW11	8.0	8.0	63/116
HW12	8.5	8.3	56/99
HW13	6.0	7.5	80/107
Final Examination	154	93	10/141

Final Exams may be picked up from your instructor's office.

Figure 1 Sample report returned to a student at semester's end.

Welcome: One line identifying the mail as coming from the Department of Physics and Astronomy Grades Reporter.

Database Date: The time and date at which the database was last updated indicates to the student how current the information in the report is. The date is that at which the *last* instructor updated it, which may be more current than the set of data relevant to a particular student in one of the *other* sections.

The Report: The body of the report consists of four columns which contain as many rows as there are grade components for which at least one student has a non-null record. At the beginning of the semester reports will have only one row, while in the figure generated at the end of a semester, there are 17. There is no effective limit to the number of components which may be stored and retrieved.

Grade Component: This is a right justified description of the component of the grade whose results are shown on each row. Only the rightmost 22 characters are printed.

Your Score: This is the score contained in the database for this component of the student's grade. If there is no score recorded, this is indicated with two dashes. If the average score

for class for a particular component is less than or equal to 10, the score is reported with one digit following the decimal point. Otherwise, it is given as an integer.

Class Average: The average of this component over all students with non-null records. If there is no student with a score recorded, the component is not listed. The precision of the reported value is the same as the student's score.

Your Rank: This is a two-component quantity in the form "*rank/count*" where *rank* is the rank of the student on this component, and *count* is the total number of students with non-null records for this component in the database. If multiple students receive the same score, they are each awarded the same, and highest, rank. (If everyone receives the same score, everyone is ranked first.) If the student does not have a score recorded, the rank is indicated as "none."

Message: The report is completed with an optional message from the instructors.

If the requester's username is not located in the database, the Grades Reporter assumes that a legitimate student is requesting his/her grades, but has failed to register a username with the instructor. The report then consists of what information is legitimately available to anyone, followed with a presumably helpful message as shown in Figure 2.

```
Welcome to the Department of Physics and Astronomy Grade Reporter.
The database for this report was last updated:
Thu Sep 15 14:05:50 1994

      Grade      Your      Class      Your
      Component  Grade      Avg        Rank
Midterm 1      --         66         none
Midterm 2      --         76         none
      HW 1       --         8.2        none
      HW 2       --         6.5        none
```

Your record has not been located.

The reason is probably that your instructor did not have your e-mail address as of the date given above. The Grades Reporter relies on your e-mail address communicated to your instructor in order to protect the confidentiality of your records.

Of course, you must be registered in the above course for the current semester in order to appear in the database.

As soon as your instructor adds your username to the database, this process will be able to respond more appropriately to your requests.

Figure 2 Sample report when student is not located in database.

IV. The Faculty Perspective

A. Operation

Maintenance of the grades database by instructors consists solely of updating grades in the database. This is done by editing a single plain ASCII text file. The format of this file is described later in this Users Guide.

B. Files Affecting the Database

Usually, the database for a single class will reside in a directory devoted to the database, although the functioning of the Grades Reporter does not rely on this. The database itself is a single file, but there are several other files associated with it which must reside in the same directory. A sample directory listing for the *phys151grades* database is shown below.

```
hostname> ls -lga
total 8
drwxrwx---  gould  phys-gds   512 Sep 15 18:32 ./
-rw-rw----  gould  phys-gds  1234 Sep 15 18:16 phys151grades
-rw-rw----  gould  phys-gds   223 Sep 15 18:30 phys151grades.rc
-rw-r--r--  daemon  phys-gds  1452 Sep 15 18:32 phys151grades.audit
-rw-r--r--  daemon  phys-gds   889 Sep 15 18:32 phys151grades.last_request
-rw-r--r--  daemon  phys-gds   509 Sep 15 18:32 phys151grades.last_response
-rw-r--r--  daemon  phys-gds    7 Sep 15 18:24 phys151grades.error_log
-rw-r-----  gould  phys-gds   122 Sep 15 18:21 Makefile
```

1. Permissions

The most important feature which should be noted in this directory listing is the permissions field. Every file used by the Grades Reporter must be readable by the group, presently named *phys-gds*. Further, the directory itself (".") must allow full access ("rwx") to the group. If any restriction is placed on the group for use of the directory, only the directory owner would be able to update the files, and the Grades Reporter would be unable to create necessary files.

In the displayed directory, which initially contained only the first two *phys151grades* files, the Grades Reporter was invoked from the mailer daemon which then created several of the files, and which it therefore owns in this example. These files, then, need only be readable by the group. If it is so desired, however, these files can be converted to ownership by any member of the group. In that case, however, group permission to write on those files must be granted before the Grades Reporter, which has then been demoted from owning the file to simply being a member of the group, will operate.

2. Descriptions of the Files

In the above listing, the name of the database file itself is *phys151grades*, which happens to be the same as the defined address (NIS alias) for the request, but this is not required. In the descriptions below, the name of the database will be taken to be *database*. The first two files are usually managed by the course instructors.

● **database:** This is the database file itself which contains the names of the grade components, each student's record, and comment lines as needed by the instructors.

This file must be present or electronic mail is bounced to the student indicating that an Internal Grades Reporter Error has occurred. The error message is not very illuminating. Future enhancement here may occur.

● **database.rc:** This file is intended in future versions of the Grades Reporter to permit customization of the database. For example, owing to limitations of at least one popular spreadsheet which cannot represent *null* values as anything other than a zero, the presence of a zero is currently taken to mean that the student has no score, not that his/her score was zero.² The `.rc` file will eventually be used to allow a score of zero to exist in the database. Other customizations are considered.

Presently, however, the only function of this file is to permit instructors to append a closing message to the report delivered to students. Any text in the file before a line beginning with the string "[Message]" will be ignored. Text on the same line following this string is ignored. All text beginning with the next line until the end of the file is simply copied onto the end of the report.

This file is optional. If it does not exist, no message follows the final grade component.

The following files are usually maintained by the Grades Reporter.

● **database.audit:** To the instructor, this is the usually most interesting file generated by the Grades Reporter because it is the only record of which student requested a report and when. Each received mail is recorded on a single line as in the following sample from a previous semester:

Mon	May	2	02:22:36	1994	wyckhous@scf.usc.edu	Sam I Am
Mon	May	2	02:39:51	1994	jerinsky@scf.usc.edu	Tara Jerinsky
Mon	May	2	02:48:38	1994	dheath@scf.usc.edu	David Heath
Mon	May	2	02:50:02	1994	ggonzale@scf.usc.edu	Gerardo Gonzales
Mon	May	2	02:53:31	1994	staggeme@scf.usc.edu	Annie-O
Mon	May	2	03:15:09	1994	mreaves@scf.usc.edu	suck my kiss
Mon	May	2	03:18:09	1994	guillory@scf.usc.edu	Nathan Guillory

The time is taken from the system when the Grades Reporter is invoked by the mailer. (As can be seen in this sample, students concerned about their final grades can become quite interested in the Grades Reporter near the end of the term.) The username (with return machine address) and "Real Name" are taken from the received mail header. Note that the "Real Name" is often a made-up name.³

● **database.last_request:** This is the text of the most recent request received for this database. Its main purpose is to facilitate debugging if an unexpected error should result from a student's request (and we learn of it soon enough).

● **database.last_response:** This is the text of the last response sent out by the Grades Reporter from this database, in response to the `.last_request` above.

² It is, of course, possible that a student *could* receive a zero, but the fact that it is extremely unlikely means that this limitation is not currently a significant concern.

³ This semester one of my students gave his "Real Name" as "Derrick Coleman." Isn't he a famous basketball player? A week later, he was someone else.

- **database.error_log:** This file also exists as a debugging aid, and should ordinarily not exist in the directory. It may, however, be created in the event that access permissions to the group are not restored properly by an instructor following updating of the database.
- **Makefile:** This file is not an integral part of the Grades Reporter, but rather is one way of allowing file permissions to be reset to correct values quickly and reliably. A simple shell script is equally useful.

C. Setting Up the Database the First Time

When a new course is added to the Grades Reporter facility, or when a database is moved into a new location, only a few things need to be done in preparation for the Grades Reporter. First, you need to tell me the new location of the database, and its name, so that I can create a pointer to it.

Next you need to create a file identified as the database, and give group ownership to the Grades Reporter group, currently *phys-gds*. The database group permissions must be "*rw-*". (Execute permission is irrelevant and would be ignored if given.) The *database.rc* file, if it exists, must have group ownership by *phys-gds* and be readable by the group. Write and execute permissions are again ignored. As noted above, this file is optional.

Finally, you need set directory ownership and permissions so that the database directory has "*rx*" permissions to group *phys-gds* and that there is an unbroken path of at least "*-x*" permissions to members of the *phys-gds* group. This may be done simply by giving group ownership of every directory in the chain up to a public level to *phys-gds*. In cases where this is not possible, execute access to the world at that level will be necessary. **In no case, however, is it necessary to give read permission to the group for any directory above that of the database.** Further, it is recommended that world (non-user, non-group) access to the database directory and at least one higher level directory be prevented.

Given these steps, the Grades Reporter (merely a member of the *phys-gds* group) will be able to locate and read the database, and will create other files as needed with appropriate permissions. Further, instructors sharing the database with the owner of the database directory will also be able to update the database.

V. Database Format

The actual database file is a plain ASCII text file, divided into records and fields. Each record is a single line of text delimited by a newline character ($\backslash n$, ASCII 0A₁₆). Fields within each record are delimited by a single TAB. Fields may be NULL, which is represented by nothing between a single TAB and the next (or terminating newline). The number of fields which may be allowed is limited only by the constraint that the number of characters in a single record (especially the first

record) may not exceed 511. The number of records which may be contained in the database is unlimited.⁴

A. First Line

The first line is special because it defines the fields which are to be displayed in the report. The first field's text is ignored because it merely labels the usernames recognized in the database, and will not be printed in the report. Each field may contain any printable labelling characters, and may be as long as you wish, subject only to the drawback that if more than 22 characters are used, the output format will look funny. TABs may not be inserted in any form (*i.e.* they may not be escaped). Spaces are permitted, and will be retained exactly as placed in to the database unless they are at the ends of the label. That is, " Midterm II " will be printed as "Midterm II" with only the internal space retained.

B. All Other Lines

All other lines in the database are either student records or comments, distinguished only by the number of fields in the line. Comment lines may not include a TAB so that they consist of a single field only. Such lines are treated as a student with no scores, and hence no impact on the report. In courses with multiple sections (aren't they all where the Grades Reporter is actually useful?) comment lines are convenient for identifying the students each instructor needs to replace when updating the database.

Student record lines consist of a username, which must be in the first field, and a series of numeric values. The username in the first field will have leading and trailing spaces deleted before comparing to the username located on the requesting mail. The username recorded in the database may not contain embedded spaces.

The numeric values contained in the rest of each record may be recorded as integers or decimal numbers. In either event, they are recorded with sufficient precision to permit an accurate report. In all fields after the username, the only characters which may be used are the 10 digits and a decimal point. Negative values are not currently legal numbers for student scores in this database. This could change if there were a demand.

The final record in the database must be terminated with a newline character. If it is not, the current version will not recognize the final line, and will also fail to perform the rank calculation, reporting that the student is always first in the class.

⁴ The only limit is available disk space. Given the current free disk space of 1.6 Gbytes, and an historical average of about 50 bytes per record, the limit now is about 30 million students. Enough.

VI. Restrictions/ Limitations

...

Each student may have only one username. This username may not include any designation of machine, such as `username@host`.

Okay, guys. This is about as far as I've gotten in the time I have to spend on this task. The rest of this User's Guide is just quick sketches of ideas that I need to write up more coherently.

and non-limitations: no limit to # students

no limit to # grade components, except that # characters in each record ≤ 511

One report to a database -- no splitting a single file

VII. Troubleshooting

A. "No Room"

When trying to copy a newly edited database back to the directory that should contain it, the system gives you a "no room" error message. This probably means that you have a quota for your files on a different filesystem than that containing the database. Ask for your quotas with "quota -v". If the filesystem containing the database is not listed, your quota there is zero. This means that you may not be the owner of any file in the directory.

This is not a problem. As long as the database and `.rc` files are owned by the group *phys-gds* and the group permissions on these two files are "rw-" then you can edit them in place without changing the user file ownership. A problem only results if you try to create a *new* file in the directory, for instance by copying a file (such as with `cp`) from elsewhere, even if it is a copy of a file which was originally in the directory. This problem, incidentally, does not occur if you merely move (`mv`) the file because that does not change ownerships.

If this bothers you, ask to have your quota on the appropriate filesystem raised from 0 to 1 MB and at least 5 files. (The default value for file quota, though, for a 1 MB size quota is probably much greater than 5.)

VIII. Bugs

Person with same username but in a different domain will receive mail as if that person was actually registered in the class. Possibly a good thing for real students with preexisting e-mail addresses outside.

I'm told that it's possible to fool some mailers into putting false information into the mail headers, so that mail could look like it comes from a current student, when in fact it does not. In this case,

the student whose name was forged would get a report he or she did not request, but the forger would ordinarily still not have access to the grades (because mail would be directed to the current student). However, I have never seen such a forged mail header, and have asked several people to produce such a thing in mail to me, to no avail. I believe this is almost no concern. Machines on USC's OpenNet may permit root access users to overcome this security fence. If that ever proves true, I will address the problem. A number of solutions are possible, but the effort seems unnecessary to date.

Database files cannot have the last line end before a newline character. At least one important ASCII editor (textedit, I think) leaves the last line hanging. Nick Warner's NeXT does the same thing. A simple test of the file is to "cat" the file and see where the monitor prompt appears — on the same line as the last record, or the next.

IX. Possible Future Enhancements

Distinguish zero scores from NULL.

Negative scores.

"Help" in subject line.

X. Grades Reporter Internals

In the beginning, the world was dark and without form. And there was no Grades Reporter. And then UCS spaketh, saying "Let there be a new NIS alias over the whole of the domain `usc.edu` directing mail requesting grades to the machine `physics`." And there was light.

On the second day UCS spoke, saying "Let there be an entry into the `/etc/aliases` file on machine `physics` directing mail to the Grades Reporter program." And UCS saw that it was good.

On the third day another spoke, saying, "Let there be a Grades Reporter program to help all who inquire thereof." And it was so. Seeing that it was good, UCS added the program to the restricted set of programs which are allowed to be invoked by the mailer daemon. For this set is restricted for security purposes. Such was the morning and the evening of the third day.

On the fourth day the other spoke, saying "Let the Grades Reporter acquire effective membership in the group `phys-gds` through the standard UNIX `setgid` facility. By this means shall the Grades Reporter program be coequal with those of Mankind authorized to create and view all student grades." And it was good.

On the fifth day yet another spoke, saying "Let there be a grades database containing all that we wish to convey." And it was good.⁵

On the sixth day the first other spoke, saying "Let there be a pointer in a local configuration file pointing to this database, and all other databases, so as to make an unbroken chain from the NIS alias to the database." And it was good.

And on the seventh day, seeing that all that was necessary was finished, they rested.

XI. Notes to Myself

This is a User's Guide in progress. This section is for current ideas and requests for enhancements.

Enhancement: Recognize group readability error and respond appropriately. If the `.rc` exists but is not readable, the current program exits with an error, but should probably continue to completion with a note regarding the missing message line sent to the student at the bottom of the report.

⁵ The database, that is. Not all of the grades inside.