

V. Other Course Handouts

6.978: Introduction to VLSI Systems:

Background Questionnaire: The following questions are not meant to establish requirements, but are an information gathering tool to help in course and course project planning.

Name: _____ Course: _____ Year: _____

Local Address/phones: _____

Major Technical Interests: _____

M.I.T. Courses taken: 6.011 ___ 6.012 ___ 6.031 ___ 6.032 ___ 6.082 ___ 6.112 ___

Other equivalent or relevant courses taken: _____

Could you sketch the block diagram of a stored program computer? _____

Have you ever designed a major digital subsystem such as a CPU, an I/O controller, etc? _____

Could you sketch the block diagram of an assembler? _____

Have you ever designed and implemented a major software subsystem such as an assembler or compiler? _____

Describe your most ambitious software or hardware project? _____

What programming languages do you know? _____

Had any experience with graphic design languages? _____ As a user of computer aided design systems? _____

Have you any experience in the design of high-level languages? _____ Of data structures? _____

Have you ever interfaced and programmed microprocessors? _____

Had any experience in micro-programming? _____ For emulation? _____ For I/O control? _____

Could you draw the logic diagram of a 4-bit, 16-instruction ALU to the gate level? _____

Could you design, and implement in TTL, a finite state machine controller such as a traffic light controller? _____

Could you draw the current vs voltage characteristics of an MOS transistor? _____

Ever laid out an integrated circuit? _____ In what technologies? _____

If yes, what was your most complex circuit? _____

And, if yes, did you make use of a circuit simulation program? _____ Which one? _____

Could you describe the wafer fabrication sequence for an MOS-IC? _____

What do you hope to learn from this course?

6.978. Scheduling Questionnaire: (return on Thurs., Sept.28)

Your completion of the following questionnaire will help in planning the scheduling of lab sessions and possible seminars.

Place 1's in those boxes indicating times you would prefer to attend lab sessions or seminars. Place at least six 1's in the table.

Place 0's in those boxes indicating times during which you could not attend, or it would be difficult for you to attend lab sessions or seminars.

Name: _____

		MON	TUE	WED	THU	FRI
PM	1-2		0		0	
	2-3		0		0	
	3-4					
	4-5					
	5-6					
	6-7					
	7-8					
	8-9					
	9-10					

CIFTran
Users
Manual

CIFTran Users' Manual

Version 1.0

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Preface

CIF is a textual language for describing graphic items (mask features) of interest to LSI circuit and system designers. The defining document for CIF is a section entitled "The Caltech Intermediate Form for LSI Layout Description" in the text "Introduction to VLSI Systems" by Mead and Conway (to be published by Addison-Wesley).

This CIFTran Users' Manual documents the use of a particular implementation of a translator for that language. This translator reads and interprets files of CIF code, and generates several forms of output.

Independent of the type(s) of output selected, a translation pass always reads and completely interprets the CIF file in the same way, and generates syntax error diagnostic reports.

Currently implemented forms of output included commands to drive a HP 7221A four color graphics plotter, graphic commands for a Tektronics DVST graphics terminal, and an alphanumeric representation of "pen type" commands such as move, draw, and select layer.

Language Exceptions From Standard

The CIF language supported by this translator is that of the "standard" (as amended in a note dated 2-Oct-78 by Lyon) with the following exceptions. All transformations and the nesting of symbol calls (instantiations) are supported. The "P", "R", "W", and "DD" commands are currently unsupported. Unimplemented CIF commands will be reported either as unimplemented or as "unknown commands".

The following text string is an example of a complete acceptable CIF file.

```
(EX1.CIF Example of CIF code );

( Symbol definitions );

( A single box, conceived of with a lambda of 3 );
Define Symbol 1 Scale 3/1;
Layer NDif;
Box Length 4 Width 2 Center 2,1;
DF;

(
A cell consisting of two calls on the single box.
( This is a nested comment );
);
```

```
DS 2 4 1;  
Call 1 Rotate to 0,1 Translate to 10,0;  
Call 1 Translate to 0,-2;  
DF;  
  
(Main program);  
Call 2;  
Layer NPoly; Box L 30 W 10 40,40 Dir 1,1;  
E
```

Usage

The CIF translator is started by executing the program currently named "CIFTRN". Upon initiation, the program will read in various options and parameters from a file named "CIFTRN.PAR". Such a file must exist somewhere in the current search path. It is suggested that each user make a copy in his own directory, since each application will entail different parameter values. (The designation [name] of the file to be copied is <LSI.UTILITIES>CIFTRN.PAR.) Parameters are set by using a text editor to edit this file. The format of the file consists of a header and trailer which should not be modified, and a listing of option situations expressed in the following form:

<option name> = <option value>

The various option names, their function, and acceptable values are as follows:

- ISPLTO - Is Plotter Output desired on this pass. Acceptable values are T (true or yes) or F (false or no). If plotter output is requested, a particular plotter must first be allocated/assigned/connected. The policy and procedure for doing this will be selected by the teaching assistant on duty. (A "local logical name" of "HP:" must be defined to be one of the plotter connections before running CIFTRN.)
- ISALFO - Is Alphanumeric Output desired on this pass, acceptable values are T or F. If alphanumeric output is desired, a destination designator will be solicited by CIFTRN. The default is TTY:
- ISTEKO - Is Tektronics DVST graphics terminal output requested (T or F).
- ISTRAC - Is trace output requested. Tracing will cause the entry to each symbol instantiation and the beginning of each box command to be listed. Such a mode is sometimes useful for debugging. Trace output goes to the same destination as does alphanumeric output, and the destination designator is specified as documented above under ISALFO.

A CIF file specifies the layout of objects in a Cartesian coordinate system of essentially unlimited size, with the unit of measure being taken as a centimicron. Some finite region of this layout space must be selected for mapping onto display devices, and this region is called the "window". The window position and size is set with the following parameters:

WINXL - Window X of left edge, units of centimicrons.

WINYB - Window Y of bottom edge, units of centimicrons.

WINDX - Delta X (width) of window. The height of the window is determined by the aspect ratio of the display device, a value of 0.7 being fairly typical.

All files used with the CIFTran system should be "unsequenced", i.e., line numbers should not be included in the files. The default for the "standard" editor EDIT is to include line numbers unless told otherwise by either the "EU" command or the initial value command EDIT/UNSEQUENCE in a file called SWITCH.INI. Most of the other editors on the system do not include line numbers and so they should work satisfactorily.

Since the plotters are fairly slow devices it is suggested that plotter output not be requested until syntax errors have been removed. Error diagnostics are reported even if no output forms are requested, and so a pass should be made over CIF files with no output requested to scan for syntax errors. Sometimes the alphanumeric output generated by either or both the ISTRAC and the ISALFO switches is helpful in localizing errors.

Following syntax error reports is a display of the "current line". Since line ends are not syntactically significant (except as token delimiters) the current line often appears to be the line following the offending line. For example, in the CIF code segment

```
(This is a comment)
B 1 2 3 4;
```

an error will be reported for the second line since at the beginning of the second line a ';' is needed to terminate the comment command.

Acknowledgment

Thanks go to Glen Miranker for writing the software which converts graphics commands into commands for the HP plotters.

A Quick Guide to CIFT11

The program CIFT11 is an enhanced version of CIFTRN. It has three additional features:

1. True windowing - with clipping
2. Selective plotting of layers
3. Plotting sorted by layer or color.

To use CIFT11 add the line

```
ADDPAR = 1
```

to your file CIFTRN.PAR
between the lines WINDX = ... and the closing \$

That is:

```
·                               ·  
·                               ·  
·                               ·
```

becomes

```
WINDX = ...                     WINDX = ....  
$                               ADDPAR = T  
                                $
```

1. WINDOWING

With CIFT11 the origin (WINYB, WINXL) may be set to any point, and the window width (WINDX) may be set to any value. All features of your CIF file that fall in the rectangle defined by these three parameters will be plotted - filling the plotter platen.

2. When CIFT11 is run it will prompt you for additional parameters. Appropriate responses are:

(see over)

RED.	-	only red features will be plotted
BLUE.	-	" blue "
BLACK.	-	" black "
GREEN.	-	" green "
NIML.	-	" implant boxes will be plotted
NMET.	-	" metal "
NPOL.	-	" poly "
NDIF.	-	" diffusion "
NCUT.	-	" contact cuts will be plotted
NGLS.	-	" overglass cuts will be plotted
ALLS1.	-	all layers, sorted by color, will be plotted

When the layer (color) you specify has been plotted, you will again be prompted for additional parameters. If you are done type <CTRL-C>. If not, enter the next layer you want plotted.

Attached are two sample runs. Both plots of an output pad. The first run plotted only the poly and diffusion layers. The second run plotted all layers - sorted by color.

@CIFT11

CIFTRN 1.1

Enter CIF source designator: OUTPUTPADDEM.CIF

Enter additional parameters source designator.

Unit=21 DSK:LAYERS/ACCESS=SEQIN/MODE=ASCII

Enter new file specs. End with an \$(ALT)

*NPOL.\$

\$DSPPAR

WINXL= -4000.000 , WINYB= -3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=F, T, 5*F, \$

Overall bounding rectangle is:

XMin= 2100., XMax= 35700., YMin= 2100., YMax= 24600.

WAITING FOR PLOTTER TO FINISH . . .

Pass complete.

Enter additional parameters source designator.

Unit=21 DSK:LAYERS/ACCESS=SEQIN/MODE=ASCII

Enter new file specs. End with an \$(ALT)

*NDIF.\$

\$DSPPAR

WINXL= -4000.000 , WINYB= -3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=T, 6*F, \$

Overall bounding rectangle is:

XMin= 600., XMax= 35700., YMin= 300., YMax= 25500.

WAITING FOR PLOTTER TO FINISH . . .

Pass complete.

Enter additional parameters source designator.

Unit=21 DSK:LAYERS/ACCESS=SEQIN/MODE=ASCII

Enter new file specs. End with an \$(ALT)

*^C

@CIFT11

CIFTRN 1.1

Enter CIF source designator: OUTPUTPADDEM.CIF

Enter additional parameters source designator.

Unit=21 DSK:LAYERS/ACCESS=SEQIN/MODE=ASCII

Enter new file specs. End with an \$(ALT)

*ALLS1.\$

\$DSPPAR

WINXL= -4000.000 , WINYB= -3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=F, T, 5*F, \$

Overall bounding rectangle is:

XMin= 2100., XMax= 35700., YMin= 2100., YMax= 24600.

WAITING FOR PLOTTER TO FINISH . . .

Pass complete.

\$DSPPAR

WINXL= -4000.000 , WINYB= -3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=F, T, 5*F, \$

Overall bounding rectangle is:

XMin= 600., XMax= 35700., YMin= 300., YMax= 25500.

USER COMMANDS:

\$DISPPAR

MINXL= -4000.000 , WINYB= ⁴-3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=3*F, T, 3*F, \$

Overall bounding rectangle is:

XMin= 0., XMax= 37200., YMin= 0., YMax= 25800.

WAITING FOR PLOTTER TO FINISH . . .

Pass complete.

\$DISPPAR

MINXL= -4000.000 , WINYB= -3000.000 , WINDX= 50000.00
ISTRAC=F, ISALFO=F, ISPLTO=T, ISTEKO=F, ADDPAR=T, ISLSEL=T,
PLTLAY=2*F, T, F, T, F, T, \$

Overall bounding rectangle is:

XMin= 900., XMax= 33900., YMin= 600., YMax= 25200.

WAITING FOR PLOTTER TO FINISH . . .

Pass complete.

Enter additional parameters source designator.

Unit=21 DSK:LAYERS/ACCESS=SEQIN/MODE=ASCII

Enter new file specs. End with an \$(ALT)

*^C

@^C

@

M.I.T., Department of Electrical Engineering & Computer Science.

6.978. Questionnaire Regarding Project Testing:

Name: _____

Did your project get on the M.I.T. multi-project chip set? _____

If yes, are you interested in participating in project testing during IAP, assuming the wafers are fabricated in time? _____

Or are you planning to do your project testing on your own? _____

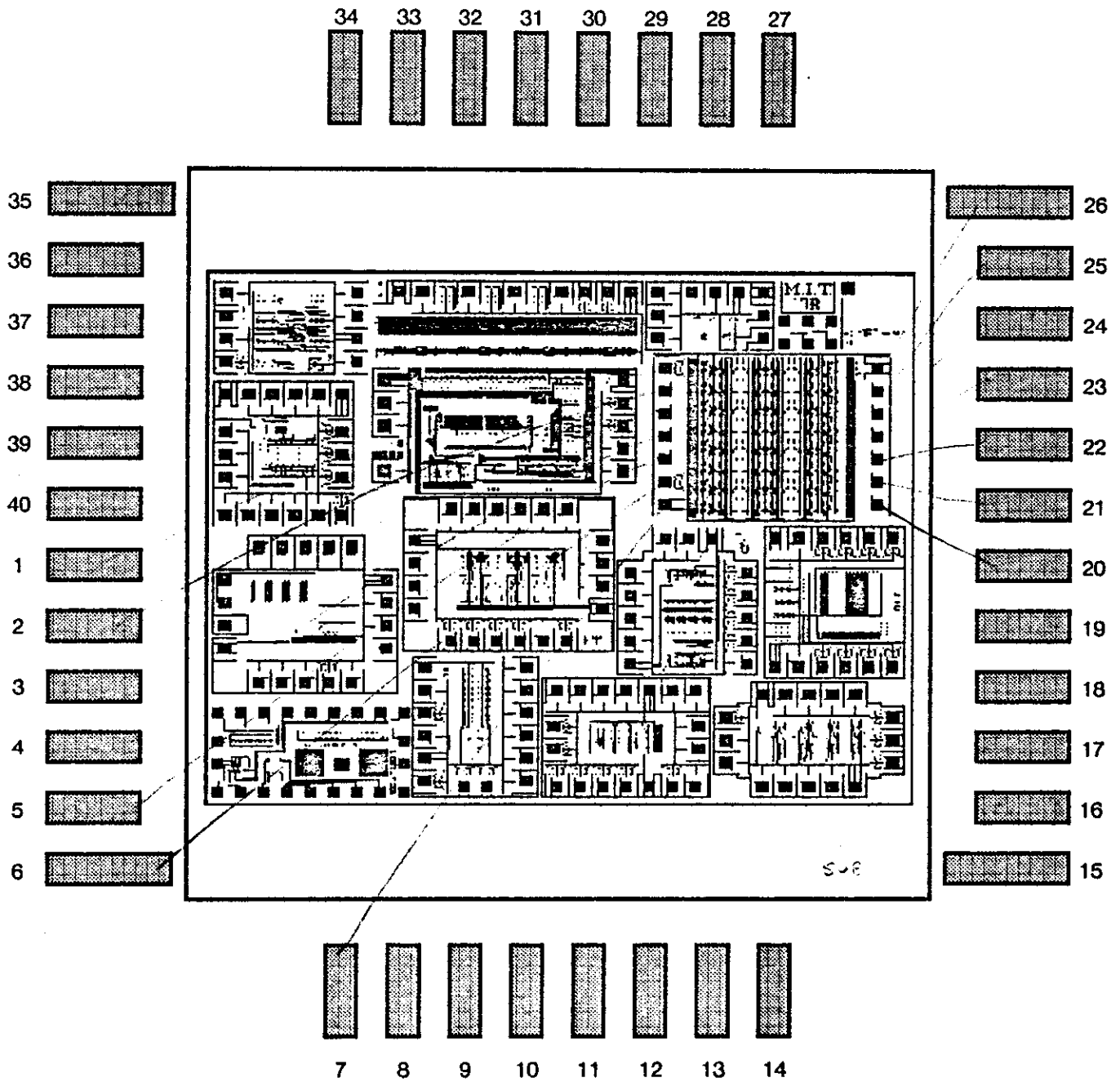
If you are interested in participating in project testing at M.I.T. during IAP, where can you be reached during January:

Address(es):

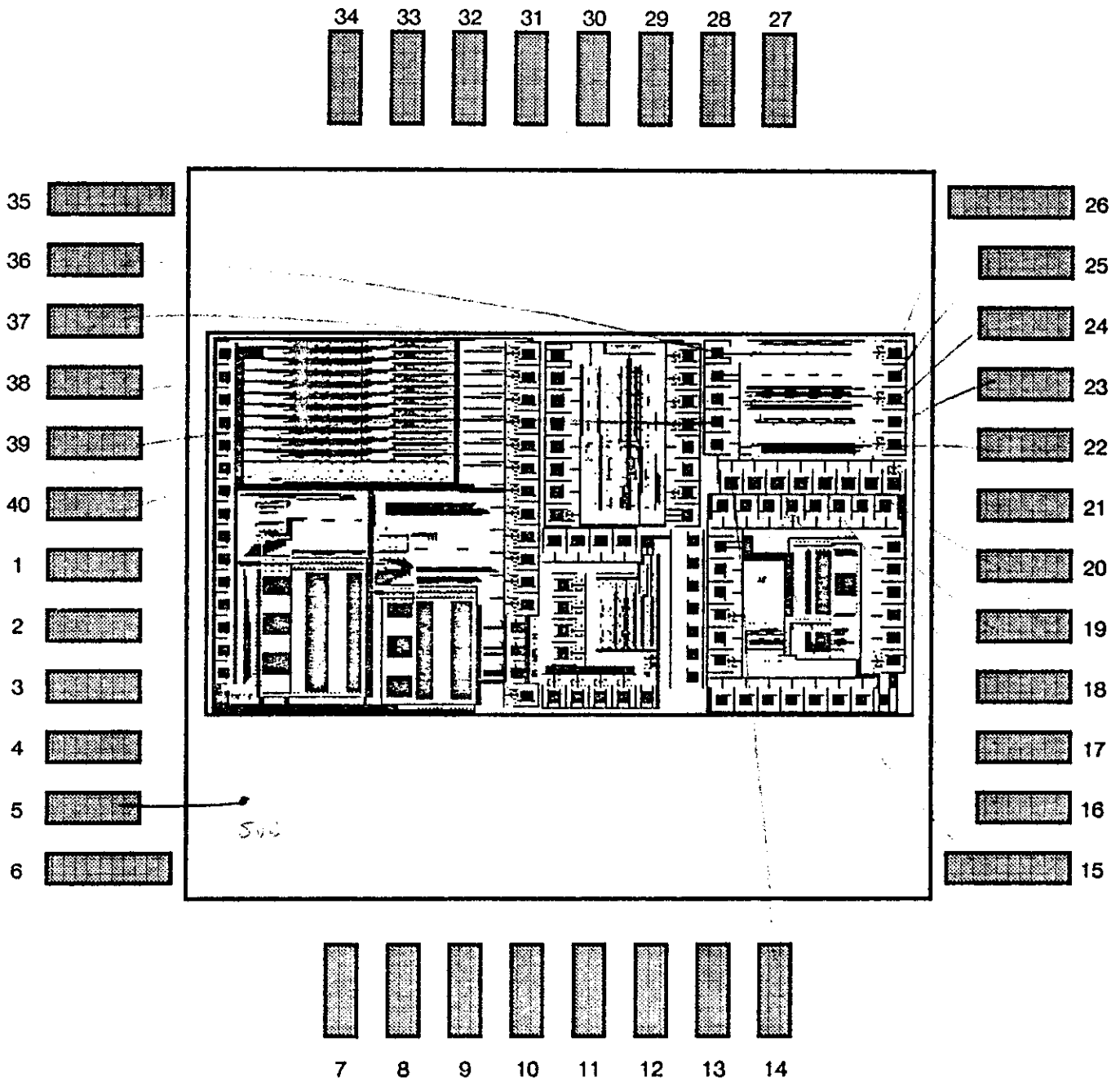
Phones:

If you are interested in receiving additional artifacts of the M.I.T. project set as they become available (project plots, both Versatec and solid color, unmounted chips, etc.), give your address for the period Feb. - May '79:

Sample Bonding Map
(Cherry)



Sample Bonding Map (Shaver)



** COURSE SIX SUBJECT EVALUATION FALL 1978 **

Instructions: Please answer questions with whole numbers between 1 and 5. If a question is not applicable, answer with a zero. These questionnaires will be reviewed by the faculty, and the results will be published next term.

Subject Number: _____

Rec. Instructor: _____

T.A.: _____

1) What is your overall rating of this subject? 1) _____
(5 = outstanding, ... , 1 = poor)

How much did you learn from each of the following?

(5 = a great deal, ... , 1 = very little, 0 = not applicable)

2) Lectures 2) _____

3) Recitations 3) _____

4) Tutorials 4) _____

5) Text books 5) _____

6) Class notes 6) _____

7) Problem Sets and Homework Assignments 7) _____

8) Laboratory 8) _____

9) Tests and Quizzes 9) _____

How would you rate the overall effectiveness of these faculty members?

(5 = outstanding, ... , 1 = poor)

10) Lecturer 10) _____

11) Recitation Instructor 11) _____

12) Teaching Assistant 12) _____

13) How easy was it to get help from the appropriate faculty members? 13) _____
(5 = very easy, ... , 1 = very difficult, 0 = not applicable)

14) In general, how hard was the course material for you? 14) _____
(5 = very hard, ... , 1 = very easy)

15) How was the overall pace of the course? 15) _____
(5 = too fast, ... , 1 = too slow)

In general, homework assignments were:

16) (5 = too long, ... , 1 = too short) 16) _____

17) (5 = too many, ... , 1 = too few) 17) _____

18) (5 = too hard, ... , 1 = too easy) 18) _____

In general, tests and quizzes were:

19) (5 = too long, ... , 1 = too short) 19) _____

20) (5 = too hard, ... , 1 = too easy) 20) _____

In general, laboratory assignments were:

21) (5 = too long, ... , 1 = too short, 0 = not applicable) 21) _____

22) (5 = too hard, ... , 1 = too easy, 0 = not applicable) 22) _____

Laboratory facilities were:

23) (5 = excellent, ... , 1 = deplorable) 23) _____

24) On the average, how many total hours (both inside and outside the classroom) per week do you spend on this subject? (Round to the nearest hour, please.) 24) _____

Blank questions: Please complete this section only if your instructor provides you with specific questions to be answered.

25) _____

26) _____

27) _____

28) _____

Comments: Please use the space below to make additional comments about the course. You may wish to elaborate on your answers to the questions above. PLEASE remember that your individual comments are a vital part of the Subject Evaluation process.