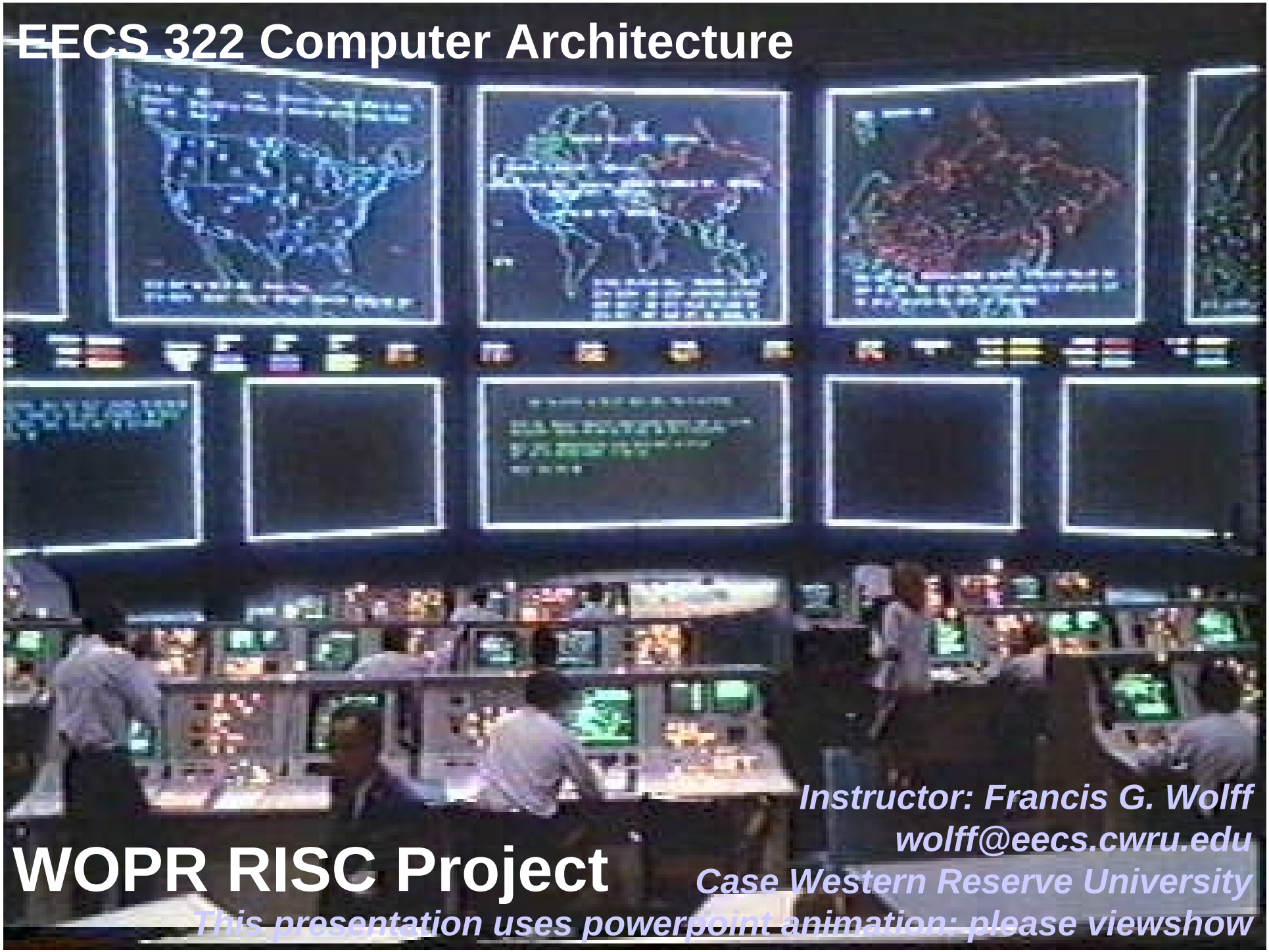
EECS 322 Computer Architecture



WOPR RISC Project

Instructor: Francis G. Wolff
wolff@eecs.cwru.edu
Case Western Reserve University

This presentation uses powerpoint animation: please viewshow

RISC Project

Teams can choose from one of two programming projects:

Conversationial & Game Project:

wopr: this program is inspired by the movie, wargames.

Each team must turn in a report which contains the following

(1) Cover sheet with up to 3 team members names & signatures

(2) Description of the problem, enhancements, & lessons learned.

(3) A flowchart of the functions: talk(), game_move(), strfind().

(4) Commented source code listing.

(5) Floppy disk of the (1)-(4).

(6) 5 minute demo with all members present.

Wopr: example

Here is an example of how the program should work

```
wopr
Shall we play a game?
Global thermonuclear War
Wouldn't you prefer a good game of chess?
tic-tAc-Toe
X: please enter your move?
1
   X |   |
  ---+---+---
     | O |
  ---+---+---
     |   |
```

Keyword matching: Search input for "War", "tic", "tac", "toe", and so on.

Case insensitive string matching

Wopr: con’t

```
X: please enter your move?
7

   X |   |
  ---+---+---
   O | O |
  ---+---+---
   X |   |
X: please enter your move?
6

   X | O |
  ---+---+---
   O | O | X
  ---+---+---
   X |   |
```

Wopr: con't

```
X: please enter your move? 8
   X | O |
  ---+---+---
   O | O | X
  ---+---+---
   X | X | O

Draw. Game over.

Shall we play a game?

My name is Bill Gates.

What is your name, again?

bill from Seattle, Wa.

Bill,Shall we play a game?

not now.

logoff.
```

Wopr: functions

(see Appendix A & A-22)

Write at least these functions (using MIPS register conventions):

```
main()                      # Main program: calls talk & game
talk()                      # 0:exit, 1:play game
game_print(&array)          # prints the tic-tac-toe board
                            # player: 0=O, 1=X, -1=blank
game_init(&array)           # initializes the board to blank
game_set(&array,position,player)
game_move(&array,player)
gets(char *string)          # No system calls allowed
puts(char *string)          # No system calls allowed
strcmp(s1,s2)               # -1:s1<s2; 0:s1==S2; 1:s1>s2
strlower(string)
strfind(string,s1)          #1:s1 not found, 0:s1 found
```

Wopr: talk()

The talk function can be on any topic you want:

```
Wouldn't you prefer a good game of chess?
```

can become (i.e. baseball, cooking, psychology, …)

```
Wouldn't you prefer to talk about yourself?
I am very happy about myself.
Exactly, how happy are you?
...
```

By using the strfind() and combining it with logical ands and logical or you can can have interesting responses.

1) At least a one 3 level logical AND condition nesting is required in the program.

2) At least 3 different types of conversation pattern matching.

3) This will be graded for creativity

ANSI C: gets and puts

ANSI C Language function: char *gets(char *s) where char *s is a pointer to a pre-allocated string of bytes.

Gets returns the original pointer *s passed in.

Gets inputs each character and echos it until a newline is encountered (0x0a). The newline is not saved in the final string. The returned string is null terminated.

ANSI C Language function: int puts(char *s) where char *s is a pointer to a string of bytes to be printed.

Puts prints each character until a null is encountered (0x0a) in the string. A newline is then also printed to the console.

Puts returns the number of characters written to the console.

Rx: Memory Mapped char i/o (Appendix A-36)

IF Ready bit is true THEN there is a new data character

Receiver control status: memory address 0xffff0000

Receiver data: memory address 0xffff0004


```
Rx:  li   $t0,0xffff0000
     lw   $t1,0($t0)        #get rx status
     andi $t1,0x0001        #ready?
     beq  $t1,$zero,Rx      #no
     lbu  $v0,4($t0)        #yes - get byte
```

Tx: Memory Mapped character i/o

IF Tx Ready bit is true THEN ok to output a character

Transmitter control status: memory address 0xffff0008

Transmitter data: memory address 0xffff000c


```
Tx:  li   $t0,0xffff0008
     lw   $t1,0($t0)          #get tx status
     andi $t1,0x0001          #ready?
     beq  $t1,$zero,Tx        #no
     stb  $a0,4($t0)          #yes - put byte
```

Rx_line: Read a line from the console.

```
#Make sure -mapped_io is enabled on spim

rx_line:
      la   $s0, rx_buffer        #string pointer
      li   $t1, 0xffff0000
rx_line1:
      lw   $t2,0($t1)            # ready?
      andi $t2,$t2,1
      beq  $t2,$0,rx_line1       #no - loop

      lbu  $t2,4($t1)            #yes - get char
      sb   $t2,0($s0)            #..store it

      addi $t2,$t2,-10           #carrage return?
      beq  $t2,$0,rx_done        #yes - make it zero
      addi $s0,$s0,1             #next string addr
      j    rx_line1
```