

ECE 220

Lecture x001A - 04/25

Wrap up interrupts & examples

Recap + reminders

- MP12 due date e-mail sent
- Final exam on 12/18
 - Conflict exam requests due 12/11
- Last day of office hours - 12/11
- [Programming competition](#)
- ICES forms now available [online](#)
- [Extra credit quiz](#) should be available.
 - Extra credit based on score (35 points)

Recap - Interrupts

- Polling based I/O vs. Interrupt driven I/O
 - Need to save state of program to be able to resume later
- Interrupts similar to TRAP commands
 - Interrupt Vector \sim TRAP vector
 - RTI used to return

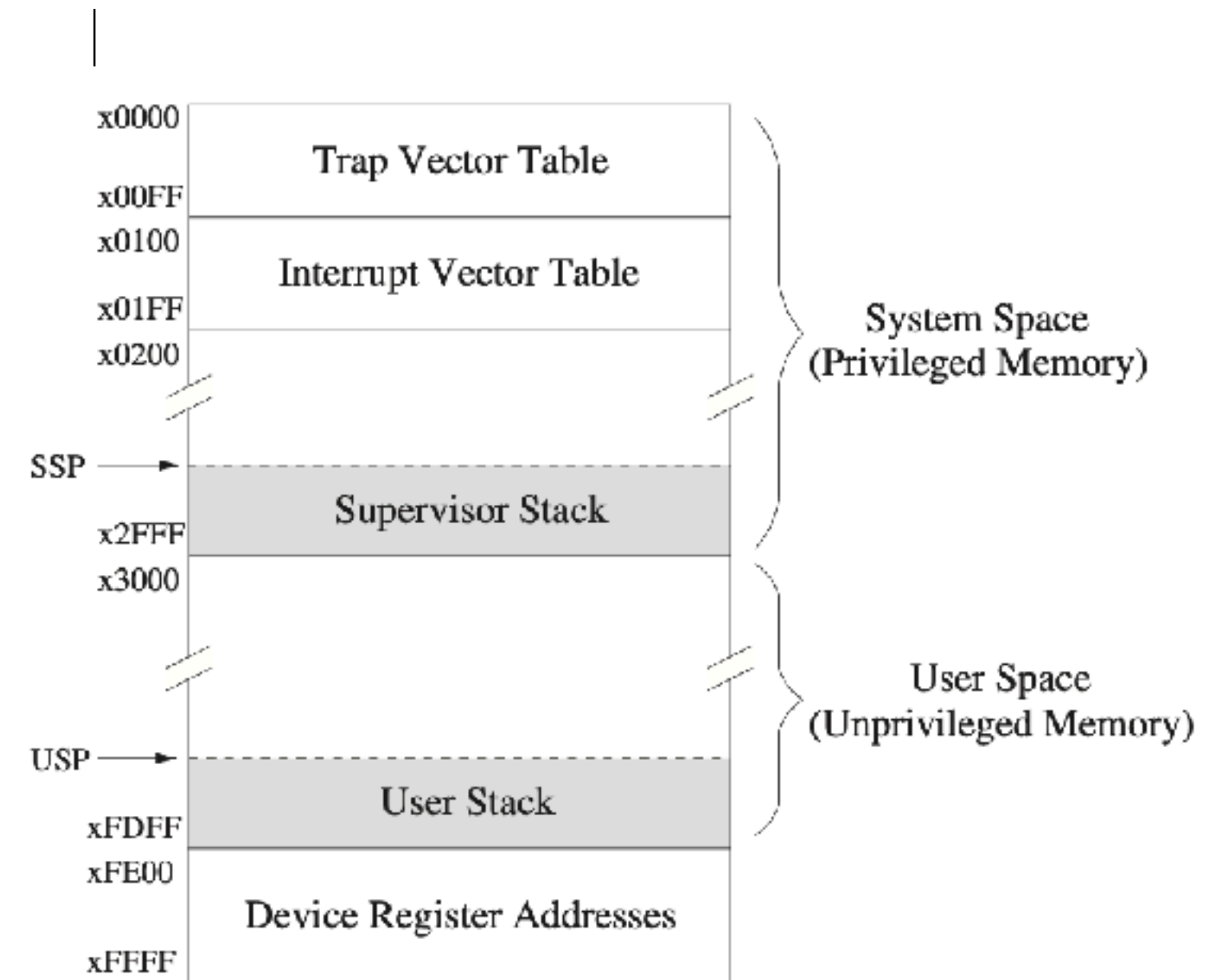
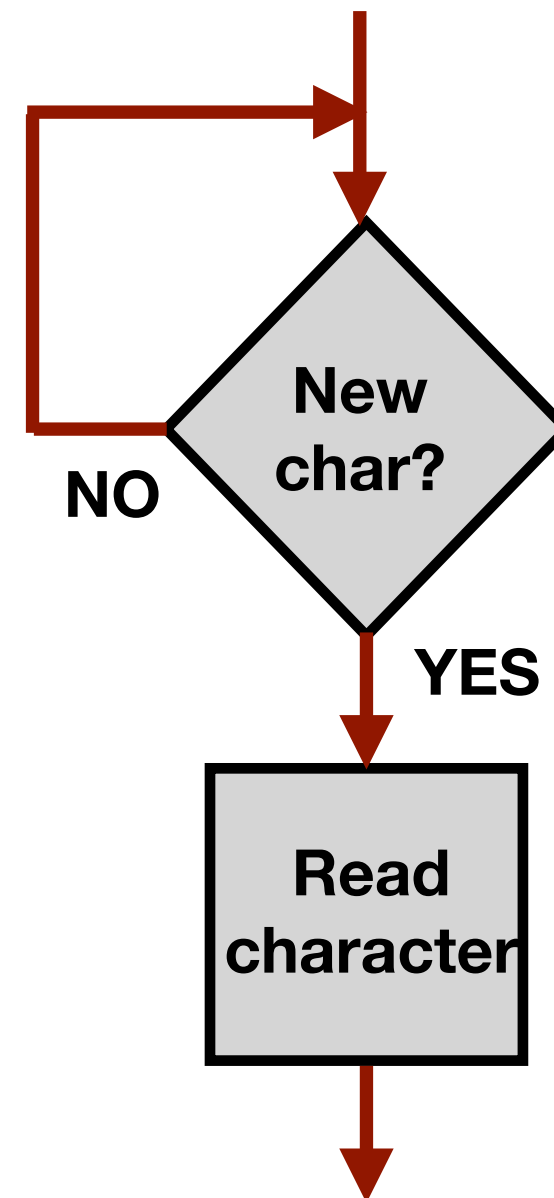
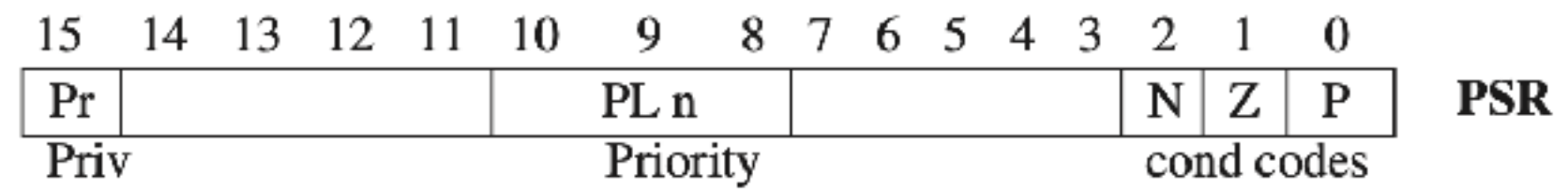


Figure A.1 - P&P 3rd Ed.



Recap - Interrupts

- What needs to be saved?
 - PC, PSR
 - R6, Saved_USP, Saved_SSP

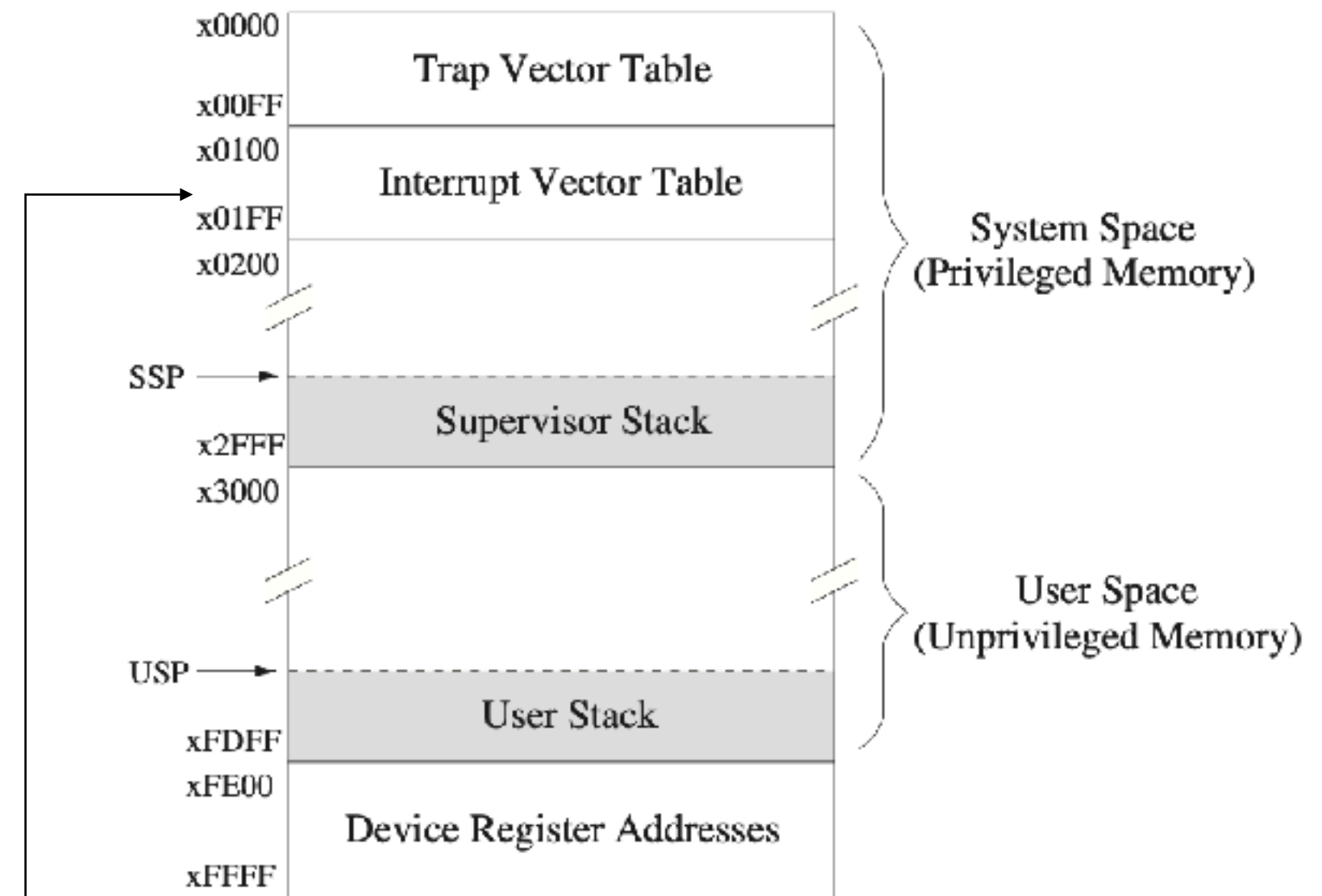
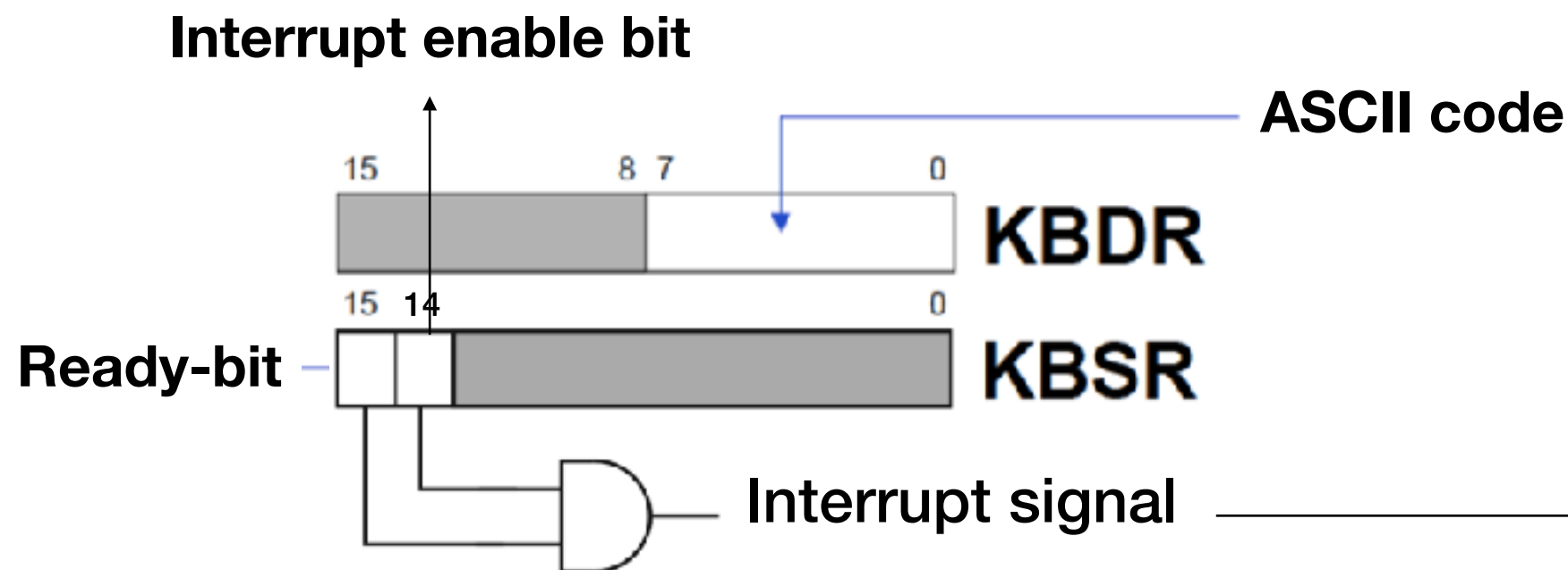


Figure A.1 - P&P 3rd Ed.

Interrupt example

```
.ORIG    x3000
        LEA    R0, ISR_KB
        STI    R0, KBINTV    ; load ISR address to INTV
        LD     R3, EN_IE
        STI    R3, KBSR      ; set IE bit of KBSR
AGAIN   LD     R0, NUM2
        OUT
        BRnzp AGAIN
ISR_KB  ST     R0, SaveR0    ; callee-save R0
        LDI    R0, KBDR      ; read a char from KB and clear ready bit
        OUT
        LD     R0, SaveR0    ; callee-restore R0
        HALT

;
EN_IE   .FILL  x4000    ; To enable the IE bit
NUM2    .FILL  x0032    ; ASCII Code for '2'
KBSR    .FILL  xFE00
KBDR    .FILL  xFE02
KBINTV  .FILL  x0180    ; INT vector table address for keyboard
SaveR0  .BLKW  #1
.END
```

What does this program do?

Review topic survey results

Q1	Q2	Q3
All of C++	Recursive	N/A
c++ constructors	x	x
LC3	Linked lists	C++ (general basics)
C to LC3	Inheritance	TRAP

- C++ has **four** votes
- LC3 and C2LC3 has **three** votes
- Linked lists and recursion have **one** each.

Plan of action

Q1	Q2	Q3
All of C++	Recursive	N/A
c++ constructors	x	x
LC3	Linked lists	C++ (general basics)
C to LC3	Inheritance	TRAP

- **Question (C++)**: Given a binary **tree** check whether it is a **binary search tree**.
 - *(Time permitting)*: If it is, convert it to a doubly **linked list**.
 - Showcase **constructors**, templates & introduce friend functions (inheritance?)
 - Will involve **recursive** functions.
 - See: https://gitlab.engr.illinois.edu/itabrah2/ece220-fa24/-/tree/main/lec26_1205

Next class

- ... (continue) convert to doubly linked list.
- Show LinkedList/Trees in LC3.
- Explain working of Virtual Function Table (i.e. dynamic dispatch).
- Semeste review.