

# SER 334 A Session

**SI Session**

**Thursday, February 15th 2024**

*7:00 pm - 8:00 pm MST*

# Agenda



Linking

Memory

Contiguous Memory

Fragmentation

Paging

# SI Session Expectations

Thanks for coming to the **SER 334** SI session. We have a packed agenda and we are going to try to get through as many of our planned example problems as possible. This session will be recorded and shared with others.

- If after this you want to see additional examples, please visit the drop-in tutoring center.
- We will post the link in the chat now and at the end of the session.
  - [tutoring.asu.edu](https://tutoring.asu.edu)
- Please keep in mind we are recording this session and it will be made available for you to review 24-48 hours after this session concludes.
- Finally, please be respectful to each other during the session.

# Interact with us:

## Zoom Features



### Zoom Chat

- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

# SER 334

## Linking Libraries

Dynamic Linking

**Only** load if needed

+ save space

- making sure  
all libraries  
are linked

Static Linking

Load everything at the start

+ all libraries  
available

- need more  
space

# SER 334

## Linking Libraries

Dynamic Linking

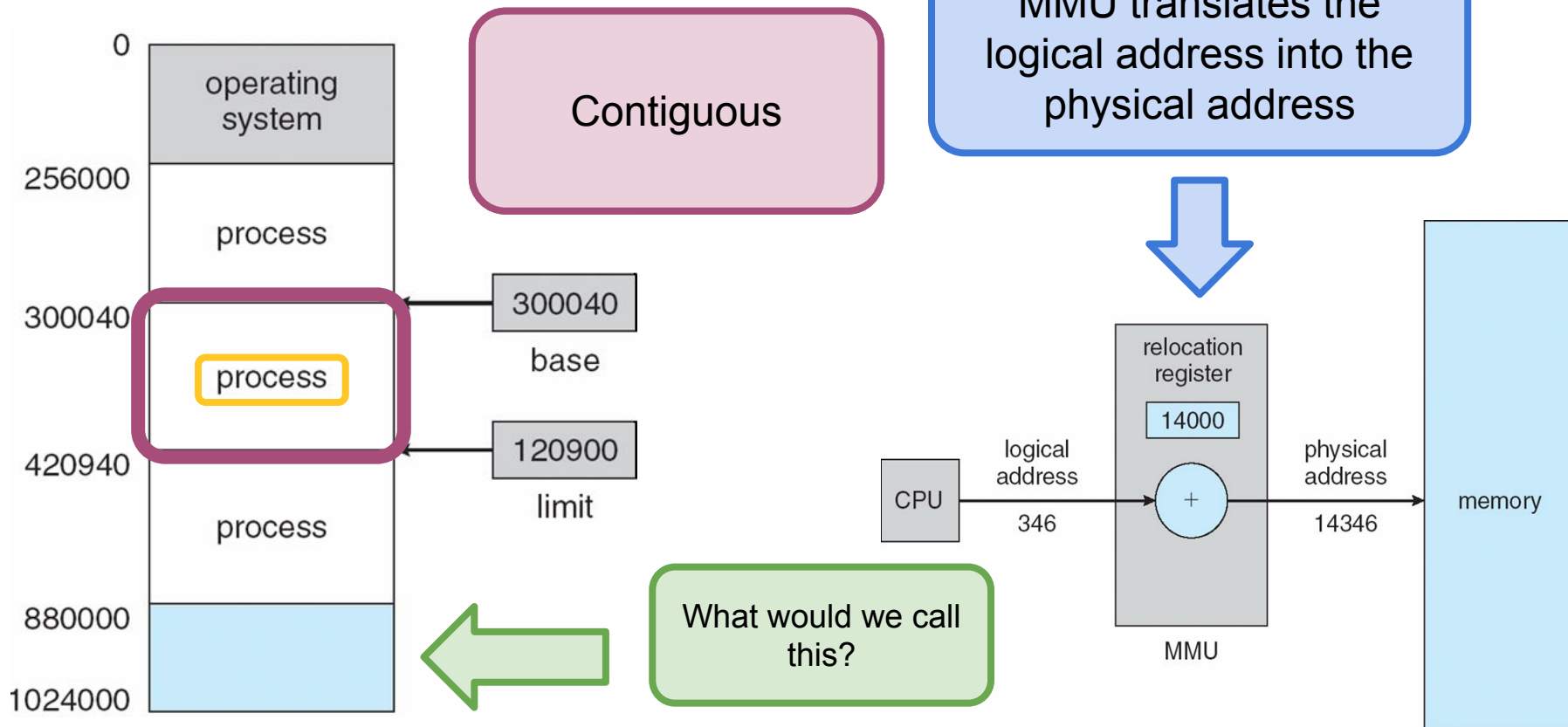
Static Linking

3. [Acuña] Consider the following scenario: you have spent several years developing an indie video game but have run out of funding, and have decided to release what you have completed to the public. Unfortunately your source code is rather messy and you only want to release binaries. Assume you want to maximize the lifetime of the game and who gets to play.

Would it be more appropriate to use a static or dynamic linking approach when doing the release build of your software? Explain.

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## Memory

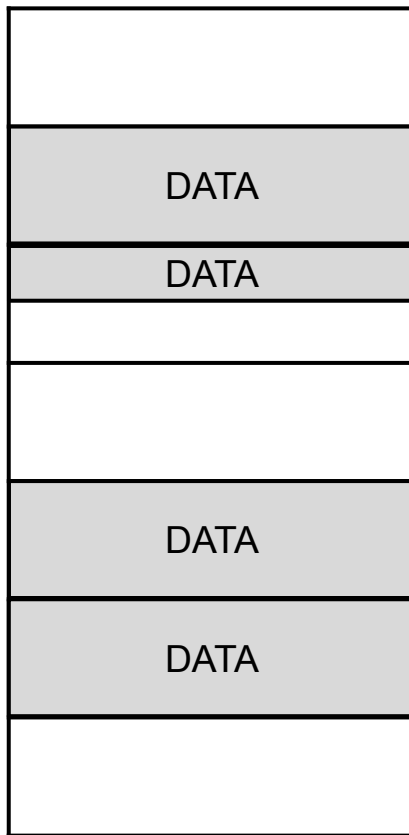


**SER 334**

**Memory**

Identify the  
***EXTERNAL***  
*fragmentation*

Physical Memory





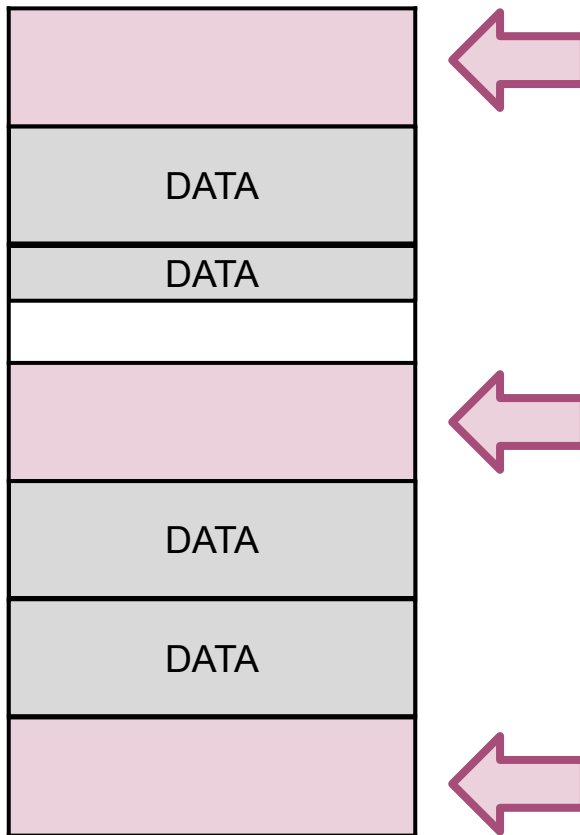
**SER 334**

**Memory**

Identify the  
***EXTERNAL***  
*fragmentation*

Identify the  
***INTERNAL***  
*fragmentation*

Physical Memory

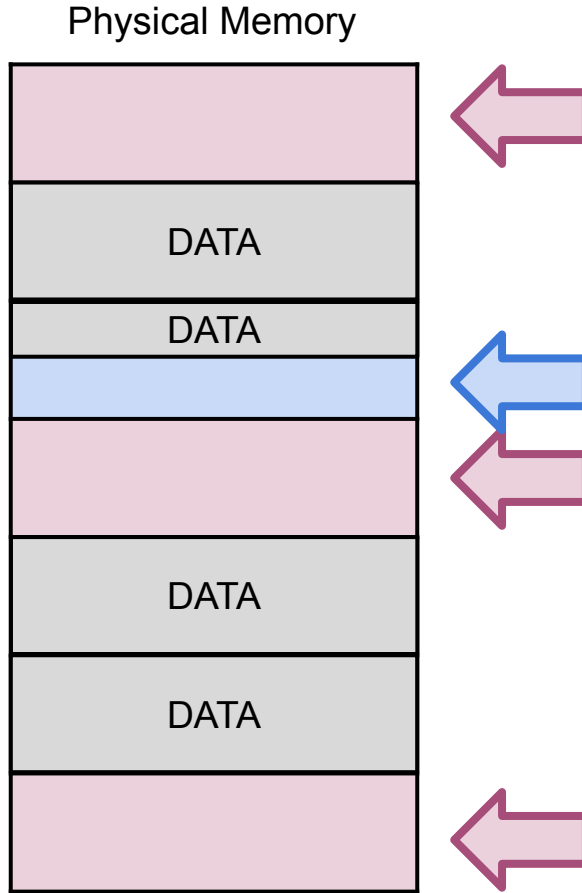


# SER 334

## Memory

Identify the  
***EXTERNAL***  
*fragmentation*

Identify the  
***INTERNAL***  
*fragmentation*



Tips to remember  
the difference?

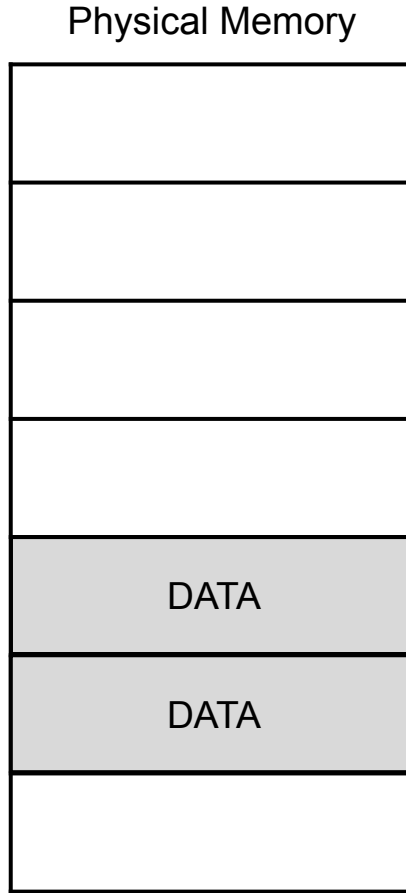
External =  
Rooms *around*

Internal = *within*  
Room

# SER 334

## Memory

6. [Acuña] In a contiguous memory allocation system, would it make sense to initialize and place processes right next to one another to reduce fragmentation? Explain.

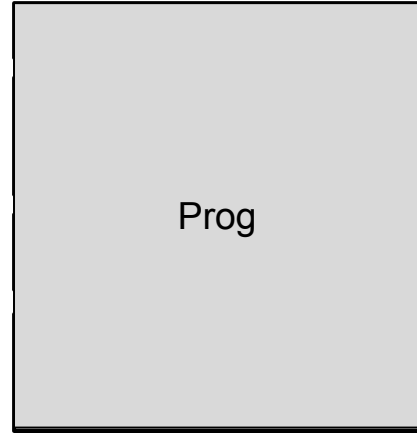


External =  
Rooms *around*

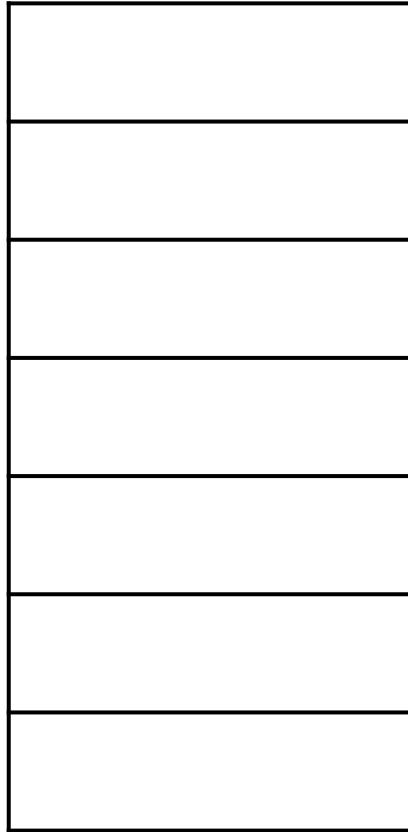
Internal = *within*  
Room

# SER 334

## Segmentation



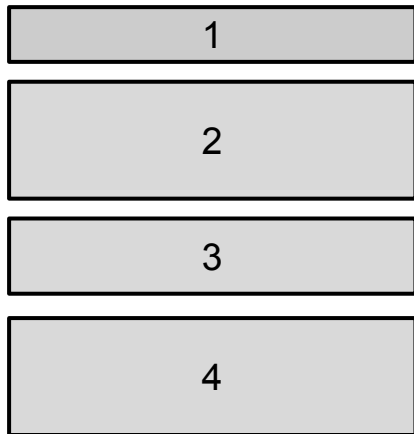
Physical Memory



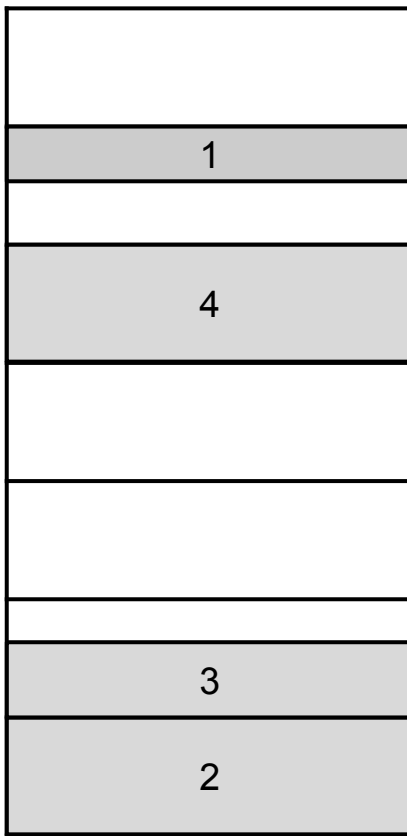


# SER 334

## Segmentation



Physical Memory

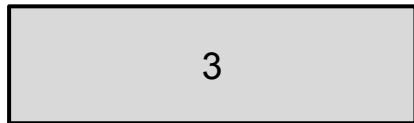


Possible  
***EXTERNAL***  
fragmentation

Possible  
***INTERNAL***  
fragmentation

# SER 334

## Paging



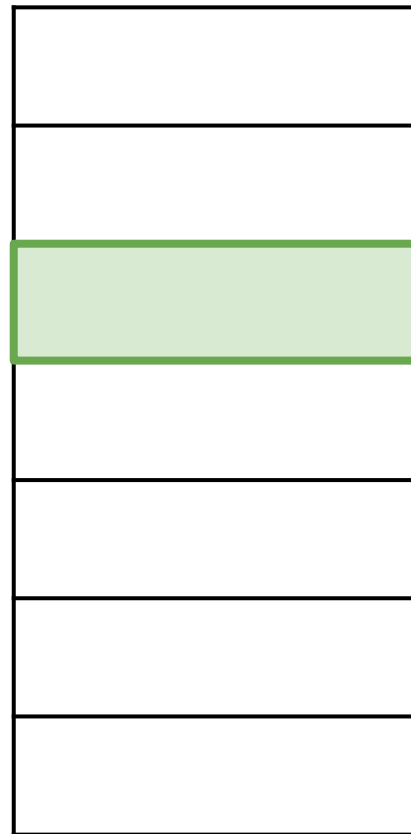
What are these called?

**FRAMES**

What about these?

**PAGES**

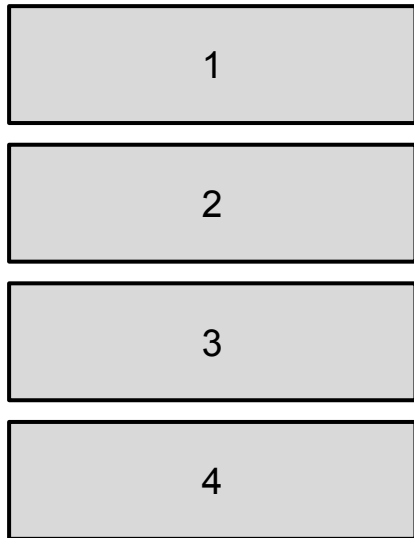
Physical Memory



# SER 334

## Paging

**UNIFORM PAGE  
SIZE (usually 4kb)**



Logical Address Size:  $2^M$   
Page Size:  $2^N$

**M**

Logical Address  
10 00

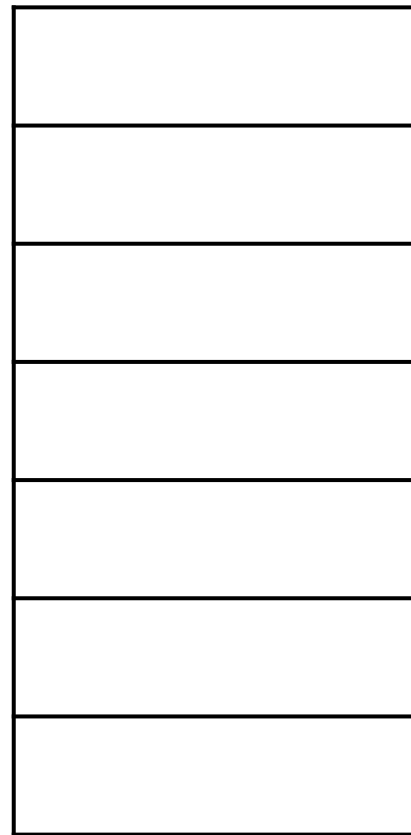
**Pg #**

**M-N**

**Offset**

**N**

Physical Memory

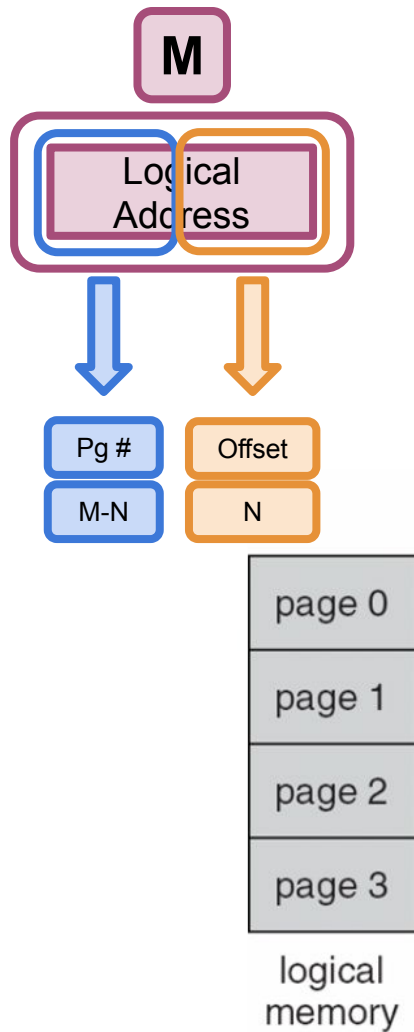




# SER 334

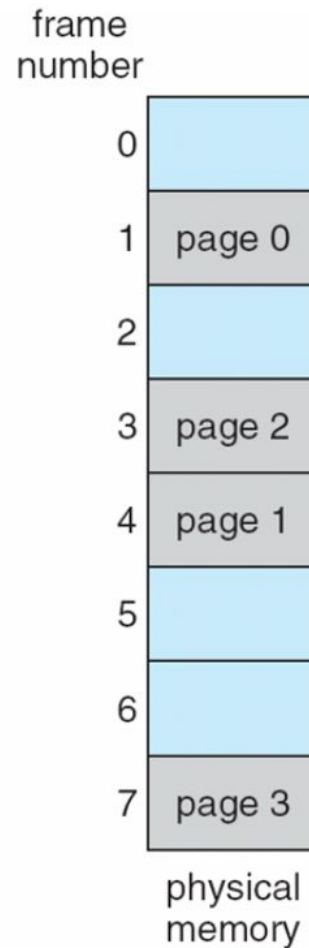
## Paging

Logical Address Size:  $2^M$   
Page Size:  $2^N$



page table

0	1
1	4
2	3
3	7



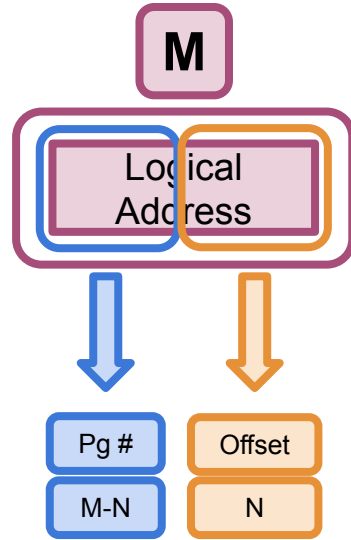
# SER 334

## Paging

Logical Address Size:  $2^M$   
Page Size:  $2^N$

## EXAMPLE

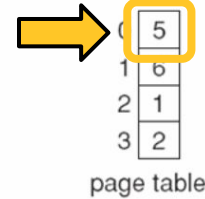
- In each logical address,  $n=2$  and  $m=4$ .
- Meaning, it uses 2-bits for offset and uses 2-bits for page #.
- Consider loading logical address 3 (0011) vs address 4 (0100).



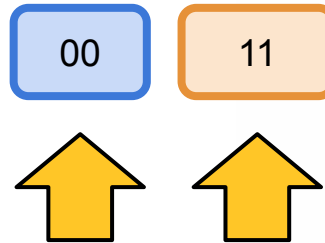
0	a
1	b
2	c
3	d
4	e
5	f
6	g
7	h
8	i
9	j
10	k
11	l
12	m
13	n
14	o
15	p

logical memory

Frame \* Page Size



How do we obtain the correct frame number?



0	
4	i j k l
8	m n o p
12	
16	
20	a b c d
24	e f g h
28	

physical memory

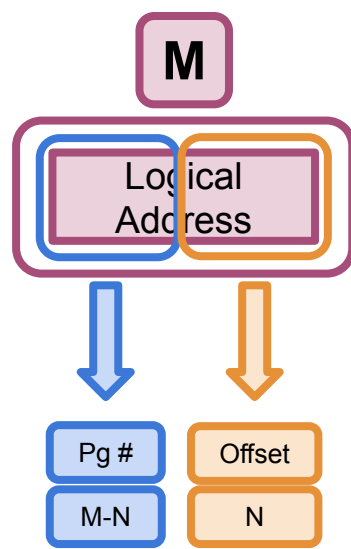
# SER 334

## Paging

Logical Address Size:  $2^M$   
Page Size:  $2^N$

## EXAMPLE

- In each logical address,  $n=2$  and  $m=4$ .
- Meaning, it uses 2-bits for offset and uses 2-bits for page #.
- Consider loading logical address 3 (0011) vs address 4 (0100).



0	a
1	b
2	c
3	d
4	e
5	f
6	g
7	h
8	i
9	j
10	k
11	l
12	m
13	n
14	o
15	p

logical memory

0	5
1	6
2	1
3	2

page table

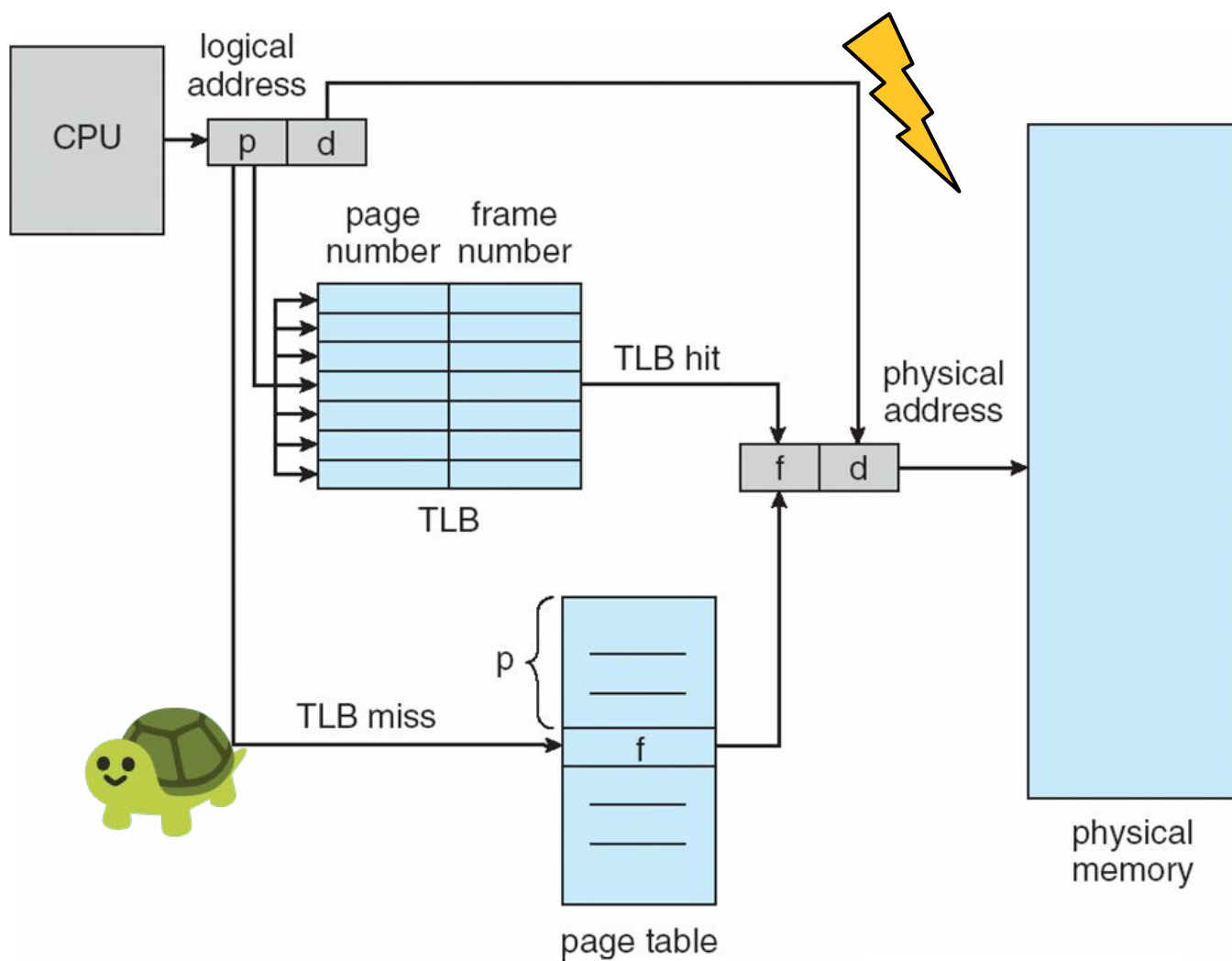
00	11
01	00
11	01

0	
4	i
8	m
12	
16	
20	a
24	e
28	

physical memory

# SER 334

## Paging



# SER 334

## Scheduling Algorithms

process, period, burst

### Rate Monotonic

Who goes first??

$$1/30 = 0.033$$

P0, 30, 15

P1, 25, 15

$$1/25 = 0.04$$

P2 starts new period

P1 starts new period

10

20

30

40

50

60

Priority =  $1/\text{period}$

# SER 334

## Scheduling Algorithms

process, period, burst

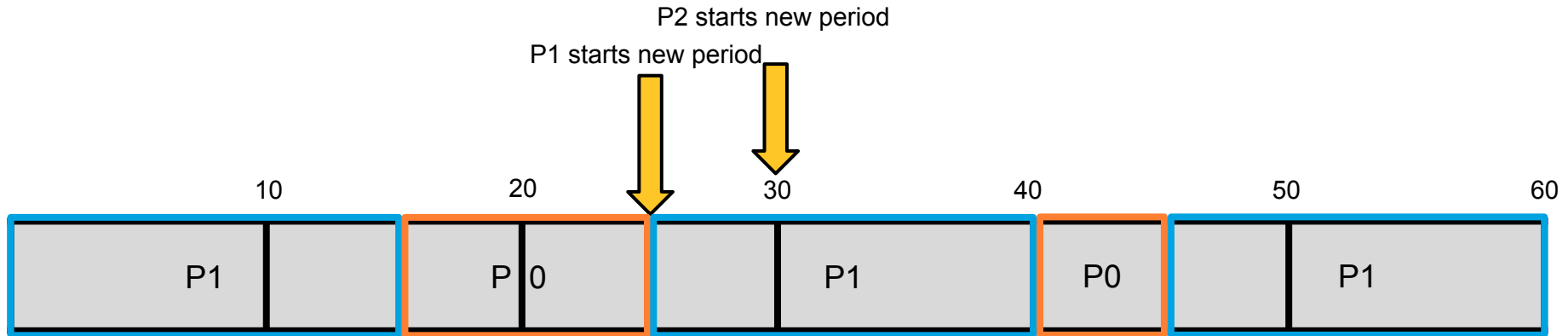
### Rate Monotonic

$$1/30 = 0.033$$

P0, 30, 15

P1, 25, 15

$$1/25 = 0.04$$



Priority =  $1/\text{period}$

P1 usurps P0

Results in P0 missing deadline!

# SER 334

## Scheduling Algorithms

process, period, burst

### Rate Monotonic

Max CPU Load:

$$1/30 = 0.033$$

P0, 30, 15

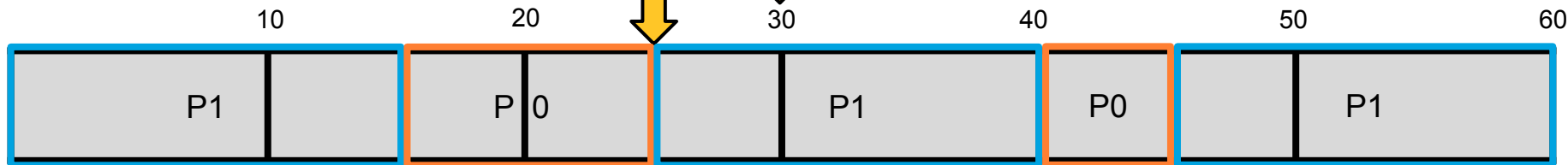
P1, 25, 15

$$1/25 = 0.04$$

CPU Utilization:

CPU Utilization:

P1 starts new period  
P2 starts new period



Priority =  $1/\text{period}$

P1 usurps P0

Results in P0 missing deadline!

**SER 334**

**Scratch Space**



## Upcoming Events

### SI Sessions:

- Sunday, February 18th at 7:00 pm MST
- Monday, February 19th at 7:00 pm MST
- Sunday, February 25th at 7:00 pm MST - Q&A Session before Exam 3

### Review Sessions:

- Exam 3 Review: Thursday, February 22nd at 7:00 pm MST

# Questions?

## Survey:

<http://bit.ly/ASN2324>



# More Questions?

Check out our other resources!

tutoring.asu.edu



## Academic Support

Academic Support Network (ASN) provides a variety of free services in-person and online to help currently enrolled ASU students succeed academically.

### Services



#### Subject Area Tutoring

Need in-person or online help with math, science, business, or engineering courses? Just hop into our Zoom room or drop into a center for small group tutoring. We'll take it from there.

[Need help using Zoom?](#)

[View the tutoring schedule](#)

[View digital resources](#)

Go to Zoom



#### Writing Tutoring

Need help with undergraduate or graduate writing assignments? Schedule an in-person or online appointment, access your appointment link, or wait in our drop-in queue.

[Access your appointment link](#)

[Access the drop-in queue](#)

Schedule Appointment



#### Online Study Hub

Join our online peer communities to connect with your fellow Sun Devils. Engage with our tools to search our bank of resources, videos, and previously asked questions. Or, ask our Tutorbot questions.

Now supporting courses in Math, Science, Business, Engineering, and Writing.

Online Study Hub

1-

Go to Zoom

2-

[Need help using Zoom?](#)

[View the tutoring schedule](#)

[View digital resources](#)



1. Click on 'Go to Zoom' to log onto our Online Tutoring Center.
2. Click on 'View the tutoring schedule' to see when tutors are available for specific courses.

# More Questions?

## Check out our other resources!

[tutoring.asu.edu/online-study-hub](https://tutoring.asu.edu/online-study-hub)

 **Academic Support Network**

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[University College](#)

## Online Study Hub

Online peer communities for students and tutors, YouTube channels, and Tutorbots.



### What are online peer communities?

Individual courses have an online peer community that allows you to connect with your peers to post and answer questions and to develop study groups.



### How can tutoring center videos help?

Videos can help supplement the learning you're doing in and outside of class and include step-by-step methods for how to understand concepts.



### How does the Tutorbot work?

You can ask the Tutorbot questions about course concepts and the Tutorbot will recommend additional resources and examples to help address your questions.

Select a subject

- Any -

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Select a subject

- Any -

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**Business**

### ACC 231

Uses of Accounting Info I

 [Peer Community](#)

### ACC 241

Uses of Accounting Info II

 [Peer Community](#)

### CIS 105

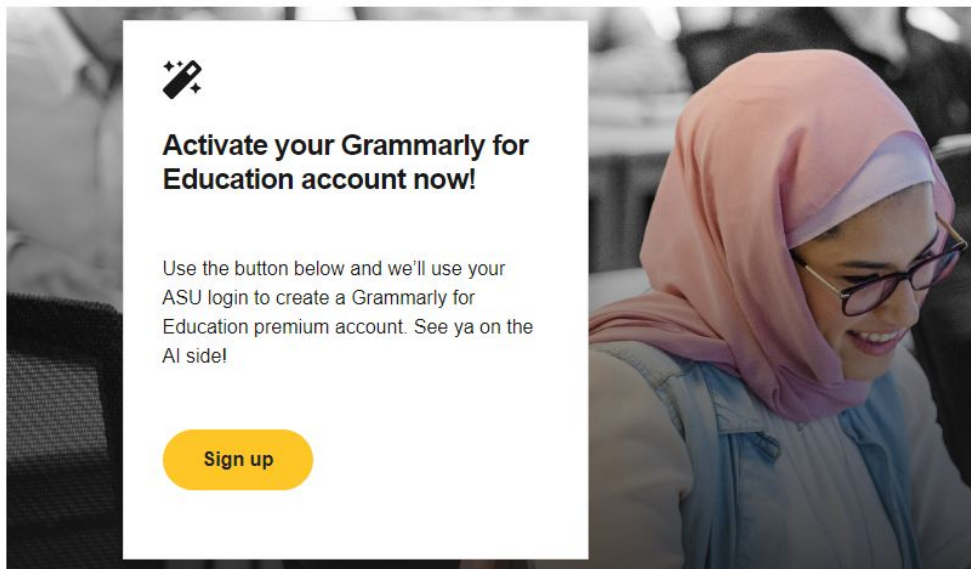
Computer Applications and Information Technology

 [Peer Community](#)

Don't forget to check out the Online Study Hub for additional resources!

# Expanded Writing Support Available

Including Grammarly for Education, at no cost!



[tutoring.asu.edu/expanded-writing-support](https://tutoring.asu.edu/expanded-writing-support)

\*Available slots for this pilot are limited

## Additional Resources

- [Course Repo](#)
- [Course Discord](#)
- [BMP File Format \(Wiki\)](#)
- [Linux Kernel API](#)
- [Bootlin - Linux Cross Referencer](#)
- [Dining Philosophers Interactive](#)
- [Producer/Consumer Visual](#)