



# Computer Science Curricular Guidance for Associate-Degree Transfer Programs

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ACM CCECC

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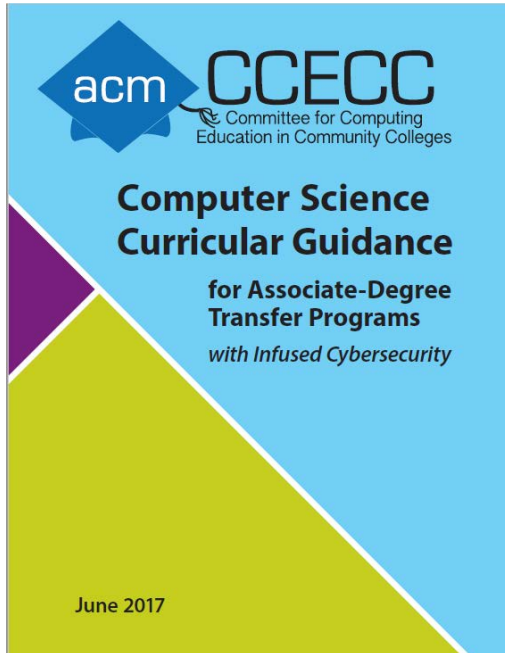
# ACM CCECC

## Global Mission

Serve and support community and technical college educators in all aspects of computing education

- **Committee for Computing Education in Community Colleges**
  - 40++ years of service to computing education
  - Standing committee of the ACM Education board for 25+ years
- Engage in curriculum and assessment development, community building, and advocacy in service to this sector of higher education

# CSTransfer2017 Curricular Guidance



- Updates Computing Curricula 2009: Guidelines for Associate-Degree Transfer Curriculum in Computer Science
- Uses Computer Science Curricula 2013 as the base to facilitate transfer
- Includes contemporary cybersecurity concepts

[ccecc.acm.org/CSTransfer2017](http://ccecc.acm.org/CSTransfer2017)

# *Outline*

- CSTransfer2017 Background
- Differences from CS2013
- Body of Knowledge
- Program Examples

# CSTransfer2017 Background

- ACM Curricular Guidance – [www.acm.org/education](http://www.acm.org/education)
- **2009**: Guidelines for Associate-Degree Transfer Curriculum in Computer Science
- **2013**: Curriculum Guidelines for Undergraduate Degree Programs in Computer Science – CS 2013
  - New knowledge area: Information Assurance and Security (IAS)
- **2015**: BoF @ SIGCSE: Perspectives on How CS 2013 Influences Two-Year College Programs – Standing room only!
- **2015**: Joint task force on Cybersecurity Education formed – ACM, IEEE-CS, AIS-SEC, CEP
- **2015**: NSF C5 Project – Catalyzing Computing and Cybersecurity in Community Colleges

# *CSTransfer2017 Background*

- **Nov 2015:** CStTransfer2017 Task Group formed
- Divide CS 2013 knowledges areas (KAs) into 3 clusters, form 3 teams
  - Team leads: Teresa Moore, Lambros Piskopos, Christian Servin
- For each CS2013 knowledge unit (KU): Appropriate for associate-degree level?
- Draft learning outcomes for each KU
  - Sources: CS 2013, NSA CAE2Y, NICE Framework, IT 2017 v0.51, Bloom's Taxonomy
- **Mar 2016:** SIGCSE workshop developing learning outcomes & assessment rubric
- **June 2016:** StrawDog released; 2 surveys for input
  - Over 50 feedback responses from 8 different countries

# *CSTransfer2017 Background*

- **July 2016:** Poster at ITiCSE, Arequipa, Peru
- **Oct 2016:** IronDog released
- **Jan–Feb 2017:** Final input incorporated
- KAs, KUs, learning outcomes, assessment rubric, and Bloom's levels reviewed, tweaked, and finalized
- **Mar 2017:** Pre-release of Final version @ SIGCSE 2017, Seattle  
ACM Education Board Endorsed
- **June 2017:** Final version release @ 3CS 2017  
Available in the ACM Digital Library

# Acknowledgements

## Team Leaders

Prof. Lambros Piskopos, Wilbur Wright College, IL

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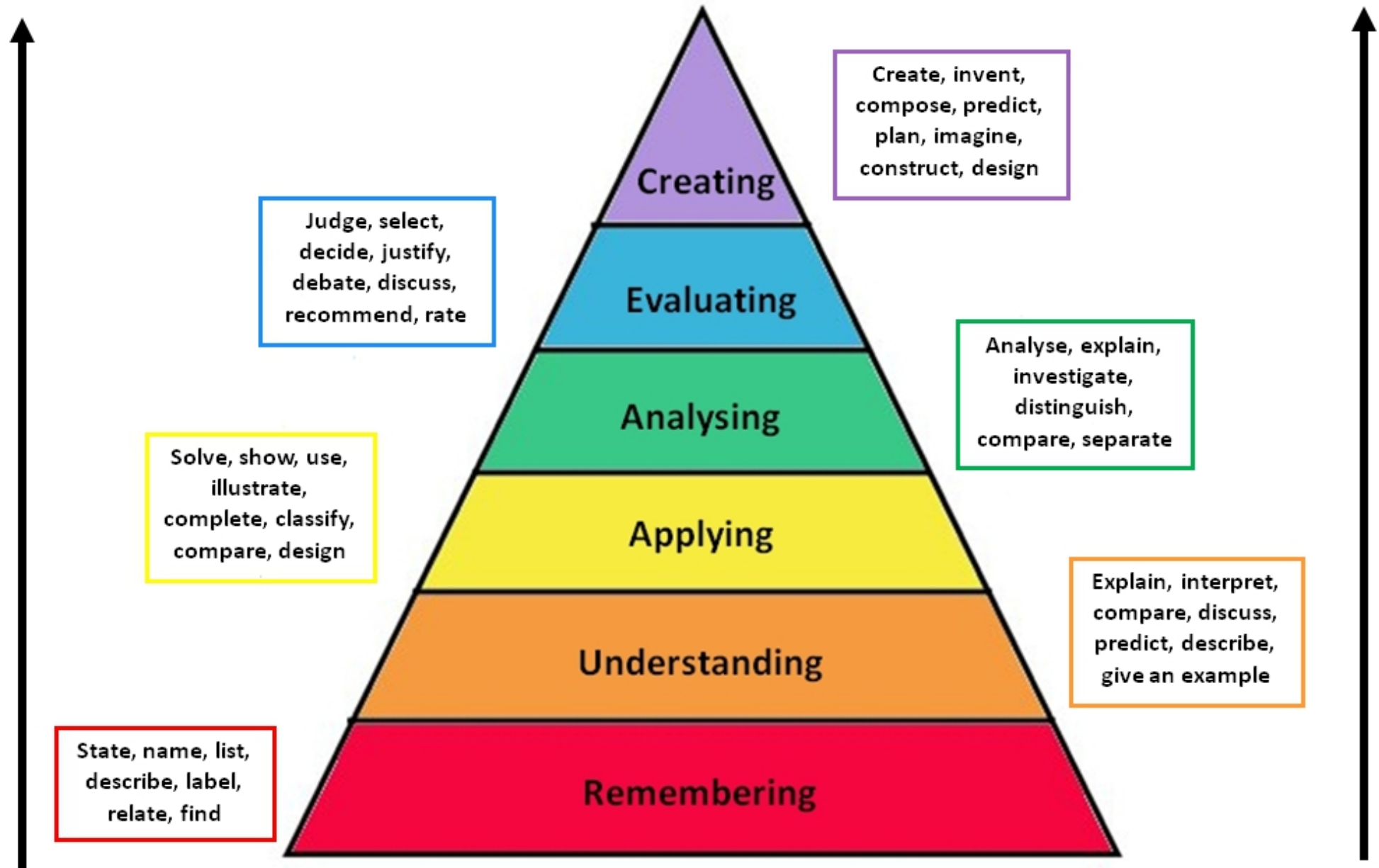
# *Differences from CS2013*

- 17 of 18 KAs included
  - 1 KA not included: Intelligent Systems
- 1 KA name change:
  - IAS Information Assurance and Security → CYB Cybersecurity
- Various KUs included for each KA
- Learning Outcomes updated
  - Utilize Bloom's Revised Taxonomy
- Assessment rubric added for every learning outcome
- No topics

# *Why Learning Outcomes Approach?*

- Focus is on **student achievement**
- Supports modification of existing courses (easier to add outcomes than entire courses)
- Also supports development of new courses
- Avoids traditional body of knowledge focus on topics and contact hours that can grow unbounded as new technologies emerge
- What topics are eliminated to make room for the new? (food fight)

# Bloom's Taxonomy



# 3-Tiered Assessment Rubric

- Every learning outcomes has an assessment rubric

Learning Outcome	Emerging Standard	Developed Standard	Highly Developed Standard
<b>CYB-15. Construct input validation and data sanitization in applications, considering adversarial control of the input channel.</b> [ <i>Creating</i> ]	Implement simple input validation and data sanitization in applications. [ <i>Applying</i> ]	Construct input validation and data sanitization in applications, considering adversarial control of the input channel. [ <i>Creating</i> ]	Develop complex input validation and data sanitization in applications, considering adversarial control of the input channel. [ <i>Creating</i> ]

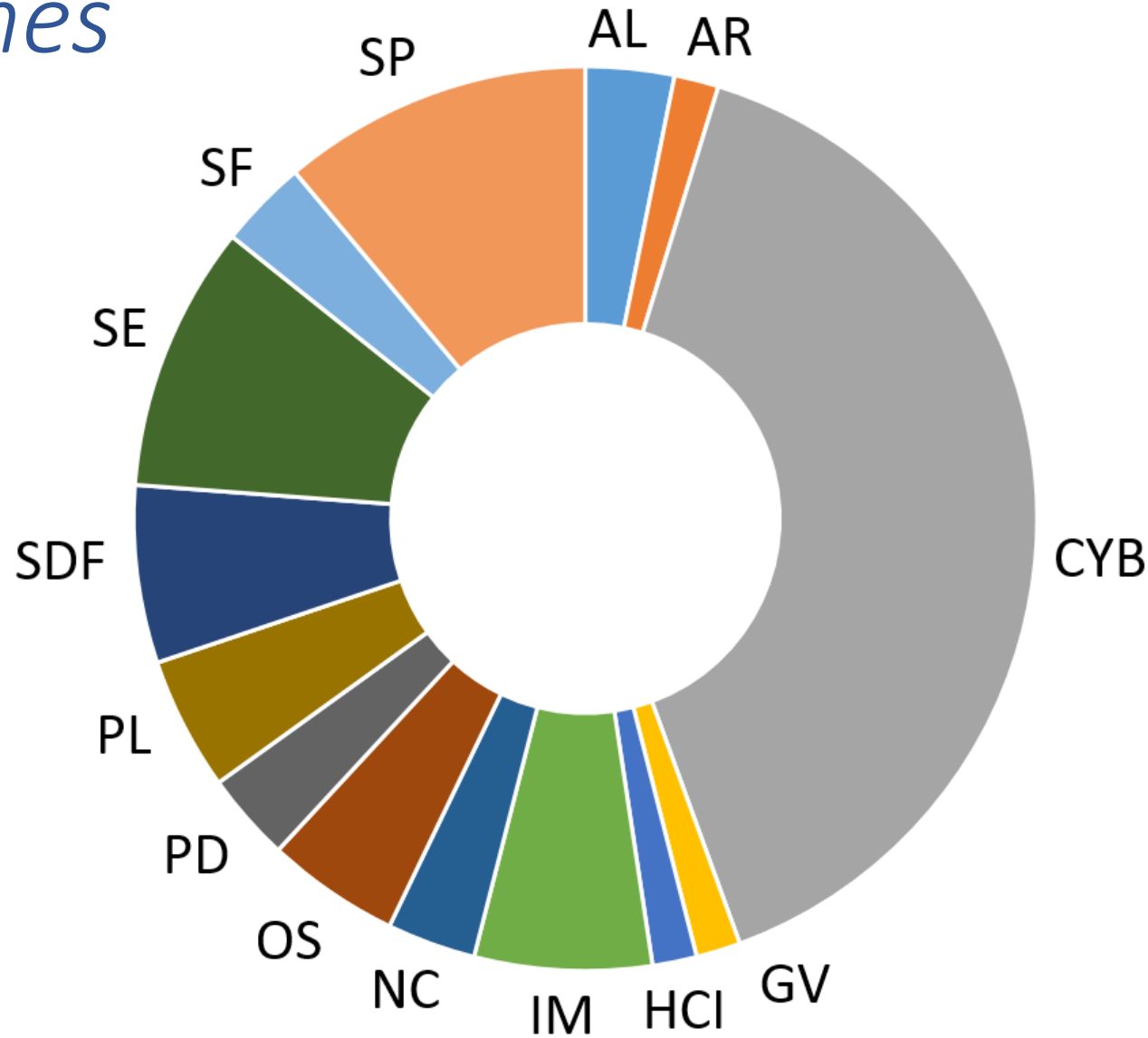
# *Body of Knowledge*

- 17 knowledge areas
- 214 learning outcomes with assessment metrics
- 63 learning outcomes specific to cybersecurity
  - 25 in CYB knowledge area
  - 38 in other KAs

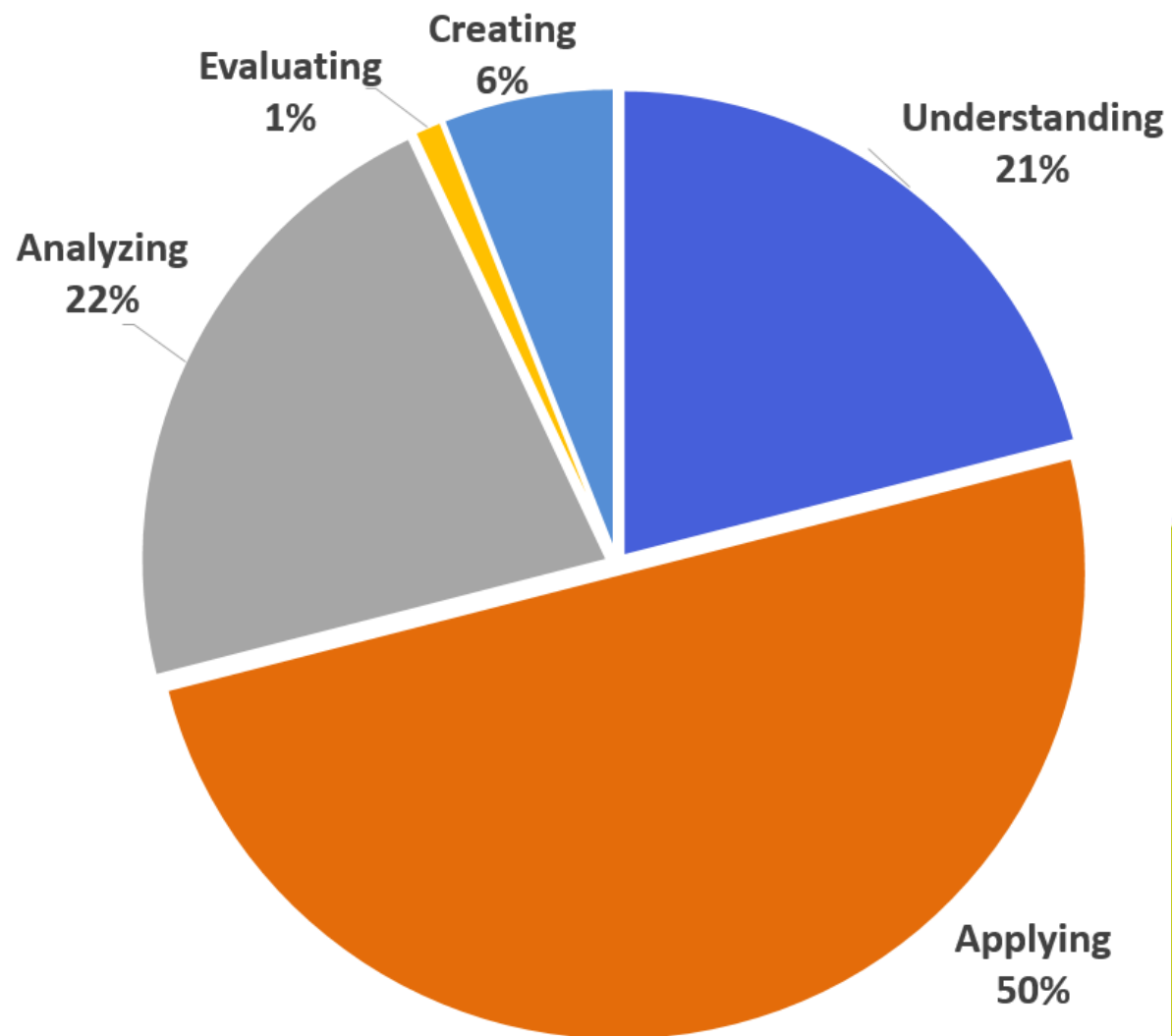
# Body of Knowledge

Algorithms and Complexity (AL) – 17 LOs	Architecture and Organization (AR) – 11 LOs
Computational Science (CN) – 3 LOs	Cybersecurity (CYB) – 25 LOs
Discrete Structures (DS) – 34 LOs	Graphics and Visualization (GV) – 5 LOs
Human-Computer Interaction (HCI) – 6 LOs	Information Management (IM) – 13 LOs
Networking and Communications (NC) – 8 LOs	Operating Systems (OS) – 13 LOs
Parallel and Distributed Computing (PD) – 5 LOs	Platform-based Development (PBD) – No LOs
Programming Languages (PL) – 10 LOs	Software Development Fundamentals (SDF) – 19 LOs
Software Engineering (SE) – 14 LOs	System Fundamentals (SF) – 9 LOs
Social Issues and Professional Practice (SP) – 22 LOs	

# Cybersecurity Infused Learning Outcomes



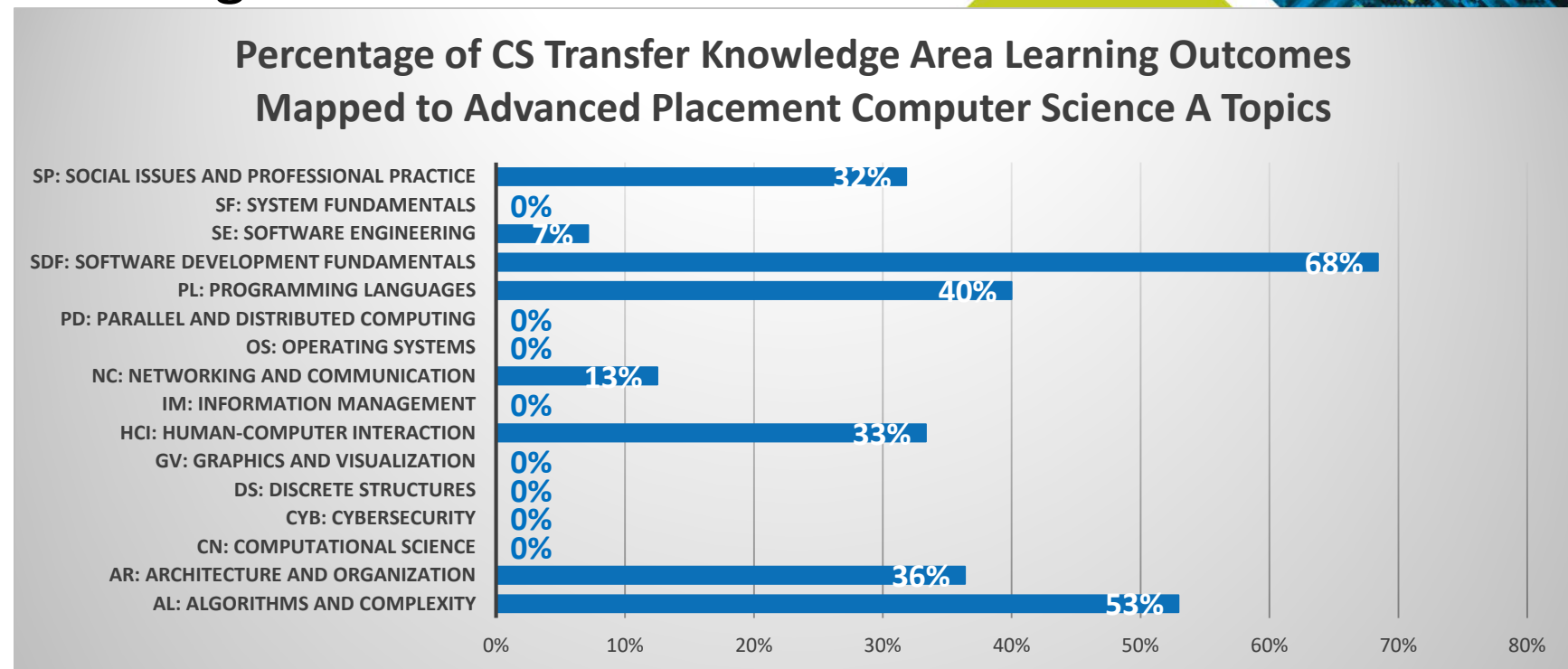
# Bloom's Levels





# Mapping to Other Curriculum, Frameworks, and Classifications

- College Board AP Computer Science A
- ACM Computer Science 2013 Guidance
- NSA/DHS CAE2Y Knowledge Units
- Others



# *Program Examples*

- **El Paso Community College**

- Two-Year **Computer Science Field of Study**
- Strong concentration in computer programming
  
- COSC 1436: Programming Fundamentals I
- COSC 1437: Programming Fundamentals II
- COSC 2336: Programming Fundamentals III
- COSC 2425: Computer Organization and Machine Language

# *Program Examples*

- **Bluegrass Community and Technical College**
  - **A.S. Transfer degree in Informatics**
  - Focus on software development and databases
  - INF 120: Elementary Programming
  - INF 260: Object-Oriented Programming
  - INF 282: Introduction to Databases
  - CIT 120: Computational Thinking
  - CIT 111: Computer Hardware and Software

# *Program Examples*

- **Folsom Lake College**

- **A.S. degree in Computer Science**

- Comprehensive exposure to Computer Science in preparation for transfer **or** entry level employment

- CISC 310: Introduction to Computer Information Science

- CISP 300: Algorithm Design / Problem Solving

- CISP 310: Assembly Language Programming for Microcomputers

- CISP 360: Introduction to Structured Programming

- CISP 400 **or** 401: Object Oriented Programming with C++ **or** Java

- CISP 430: Data Structures

- CISP 440: Discrete Structures for Computer Science

# Program Examples

Knowledge Area	EPCC Computer Science Transfer	BCTC Informatics Transfer	FLC Computer Science Transfer
AL	88.2%	76.5%	94.1%
AR	100%	63.6%	81.8%
CN	33.3%	0%	66.7%
CYB	72%	72%	88%
DS	48.4%	0%	85.3%
GV	60%	60%	60%
HCI	100%	50%	83.3%
IM	46.1%	84.6%	92.3%
NC	33.3%	75%	75%
OS	83.3%	61.5%	84.6%
PD	20%	20%	20%
PL	100%	80%	100%
SDF	94.7%	100%	89.5%
SE	57.1%	64.3%	14.2%
SF	66.6%	33.3%	33.3%
SP	86.3%	45.5%	40.1%

# *Highlight Your College's Computer Science Program*

- Submit a program example that correlates your school's degree or certificate with CTransfer2017

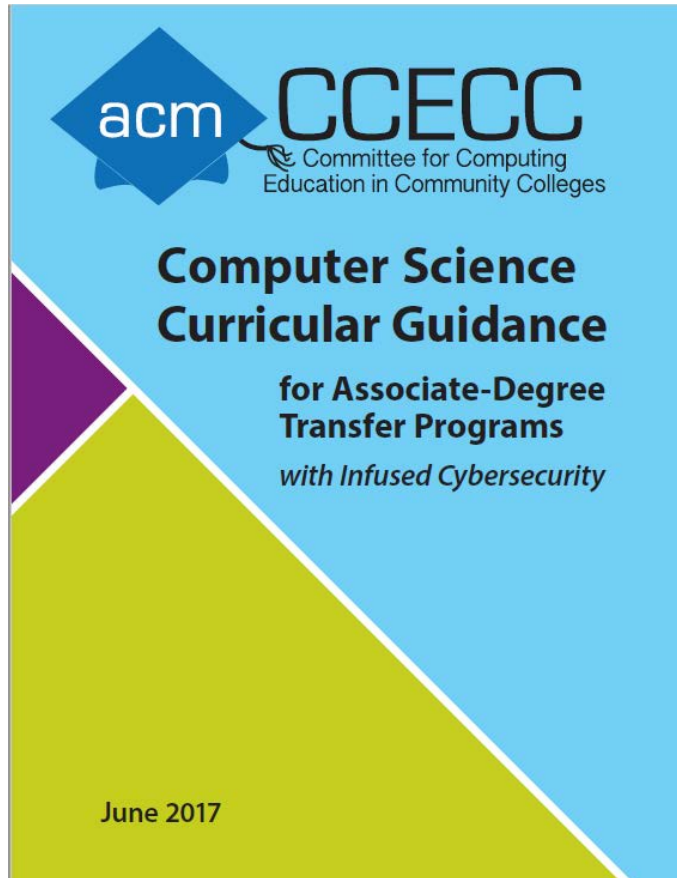
[ccecc.acm.org/correlations](http://ccecc.acm.org/correlations)

# *ACM CCECC Events at SIGCSE*

## *Join Us!*

- Exhibit Hall Booth #117
- ACM CCECC Community College Reception
  - Friday 7pm, Sharp Street Terrace
- ACM CCECC Community College Breakfast
  - Saturday 7am, 327-328

*Sponsored by Intel,  
the National  
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