Toward Curricular Guidance in the “Cyber Sciences”

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2015 CISSE – LAS VEGAS

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www.cybereducationproject.org
Outline

- CEP history, goals, and organization
- What are the “cyber sciences”?
- Why “cyber sciences” accreditation?
- Learning Outcomes approach and progress
- Support from NSF, ACM and IEEE
- Questions and feedback
- How can you help?
The Cyber Education Project

- **Who are we?**
  - Academia, Industry, Government, Professional Societies

- **What is the goal of the CEP?**
  - The goal of the CEP is to develop curriculum guidelines for the “cyber sciences” and to make the case for accreditation of undergraduate “cyber sciences” programs.

- **How is the CEP organized?**
  - Committees: Learning Outcomes, Accreditation, Stakeholder, and Steering Committee
  - Industry Advisory Board

- **How did we get here?**
What is “Cyber Sciences”?

Cyber Security
Information Assurance
Digital Forensics
Network Security
Cyber Security Management
Information Assurance Engineering
Network Administration And Security
Computer Forensics
Cyber Defense
Network Defense
Forensic Computing
Cyber Engineering
Cyber Security Policy
Why “Cyber Sciences” Accreditation?

- NSA’s Center of Academic Excellence programs have worked well increasing the number of information assurance and cyber operations programs.
- Some undergraduate cyber programs currently seek accreditation under ABET’s Computing Accreditation Commission (CS, IS and IT programs).
- The CEP sees a need for accreditation of programs like info assurance, cyber security, cyber operations, and digital forensics which have a different focus than traditional CS, EE, CompE, IS, and IT programs.
Accreditation Committee Goal

- **Goal:** Develop and submit to ABET proposed undergraduate accreditation criteria for selected disciplines within the “Cyber Sciences” umbrella

- **Target dates:**
  - **Fall 2015-Spring 2016:** draft accreditation criteria
  - **Summer 2016:** provide ABET with draft accreditation criteria for review by summer 2016
  - **Academic year 2017/18:** conduct pilot “cyber science” program accreditation visits
Accreditation Committee

- **Sources of Information:**
  - Learning Outcomes Committee
  - Existing ABET Criteria
  - Existing curricula and other bodies of knowledge
  - Stakeholders and/or Subject Matter Experts

- **Committee Collaboration Logistics:**
  - Google drive shared folder for documents
  - Google discussion group
  - Conference calls
  - Face-to-face meetings and workshops
Accreditation Activities and Timeline

1. Prepare
   Now – Sept
   - Create Collaboration Environment
   - Train/education committee members on best practices for criteria creation
   Publish Milestones:
   Learning Outcomes
   - Strawdog version: Oct 2015
   - Interim updates: Nov–Jul 2016
   - Irondog version: Oct 2016
   - Interim updates: Nov-Jul 2017
   - Final version: Jul 2017

2. Deliberate
   Oct 2015 – Jul 2017
   - Receive Learning Outcomes Committee’s observations & recommendations
   - Receive information from other sources
   - Determine/refine “focus area(s)”
   - Discuss & propose “focus area” criteria for 3. Student Outcomes, 5. Curriculum, 7. Faculty
   Publish Milestones
   Accreditation Criteria
   - Draft 1: Nov 2015
   - Interim updates: Mar-Sept 2016
   - Draft 2: Nov 2016
   - Interim updates: Mar-Jun 2017
   - Final version: Jul 2017

3. Submit
   Jul 2017
   - Prel. version: Jul 2016
   - Final version: Jul 2017

Iterate
LO Committee Membership

- Co-chair: David “Hoot” Gibson, US Air Force Academy
- Co-chair: Elizabeth “Beth” Hawthorne, Union County College, ACM Education Board
- 35-member Learning Outcomes Working Group
- Online Forum: cyberedproject Google Group
  - To join the group, send email to cohoot@gmail.com
- Meetings:
  - SIGCSE (March 2015)
  - CISSE (June 2015), ABET (July 2015)
Role of Learning Outcomes Committee

- Develop learning outcomes which characterize the knowledge, skills, and abilities gained by students in undergraduate “cyber sciences” programs.
- Build upon previous works to define related bodies of knowledge and seek diverse perspectives to build an interdisciplinary set of learning outcomes which broadly define “cyber sciences” education at the undergraduate level.
Learning Outcomes Process (1 of 2)

- Survey and review of relevant published works
  - Reviewed and ranked 47 published works, adding new works
  - Survey Monkey - http:// surveymonkey.com/s/ceplowg

- Conducting a series of workshops
  - NICE, ISEW, CISSE, others...

- Compile and evaluate existing lists of relevant learning outcomes and workforce competencies
  - Work led by Beth Hawthorne is ongoing

- Use existing knowledge area and skill competency taxonomies, propose a draft “cyber sciences” taxonomy
  - Work led by Hoot Gibson is ongoing
Learning Outcomes Process (2 of 2)

- Conduct a gap analysis of the draft taxonomy and outcomes
- Refine and augment learning outcomes and taxonomy
- Vet learning outcomes with academia, industry, and government
- Create curricular guidance endorsed by one or more professional societies, e.g., ACM, IEEE, AIS
- Inform program criteria for accreditation, e.g., ABET
Learning Outcome Target Programs

- **Level of target programs**
  - Schools developing 4-year undergraduate programs
    - Bachelor degrees
  - Schools developing 2-year lower division, undergraduate programs
    - Associate degrees

- **Possible range of target programs (notional)**
  - secure systems engineering
  - secure software engineering
  - computer and network security
  - cyber operations
  - information assurance
  - cyber law enforcement
  - cyber policy, governance, and law
  - others
Sources of Learning Outcomes

- ACM/IEEE CS2013 IAS Knowledge Area
- ACM/IEEE IT2008 IAS Knowledge Area
- ACM IT2014 Associate-degree Competency Model
- ITiCSE Towards Information Assurance Guidelines
- NSA/DHS CAE in Info Assurance/Cyber Defense
- NSA CAE in Cyber Operations
- US Military Academy Cyber Ed WG Draft BoK
- Workforce-based Competencies
  - US DHS NICE Cybersecurity Workforce Framework
  - US Dept of Labor Cybersecurity Competency Model
  - US Dept of Energy Essential Body of Knowledge
  - US DHS 2008 IT Security Essential Body of Knowledge
The LOWG will meet from 3:00 to 5:00 pm today in the Marbella Room
**Mission** of the Cyber Science Industry Advisory Board is to be a resource for the CEP steering committee through offering an industry view in the development of a “Cyber Sciences” program.

- **Role of Industry Advisory Boards is to:**
  - Review the learning outcomes document developed by the CEP LOC and categorize them as of low, medium, or high importance for personnel in cyber related positions.
- **Additionally the CEP looks to the Industry Partners to provide guidance in:**
  - Insight into job titles and descriptions relating to cyber security;
  - Develop a list of the education, training, and experience desired and/or required for personnel hired into cyber security and related positions;
  - Provide awareness of industry specific cyber security related skills most important to industry.
ACM, IEEE, and IEEE-CS are engaged with the Cyber Education Project

ACM Education Board is sponsoring a delegation to produce an undergraduate curricular volume (similar to CS2013)

IEEE-CS and AIS will be asked to form a joint task force with ACM
CEP Funding

- Travel funding for CEP leaders and key workers has been provided by the National Science Foundation.
- We gratefully acknowledge that funding for this work was provided in part by the National Science Foundation under grant number DGE-1539715.
- ACM will support its delegation as needed.
- Other partnering professional societies will be asked to do the same.
Questions and Feedback
CEP Leadership

**Steering Committee**
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**Industry Advisory Board**
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Getting Involved

- Visit [www.cybereducationproject.org](http://www.cybereducationproject.org)
  - These slides will be available at this site
- Join the CEP Learning Outcomes Working Group
- Talk to anyone on the previous slide