

**Milwaukee School of Engineering  
B.S. Computer Engineering  
Industry Advisory Committee meeting  
Friday, May 24, 2019**

## Attendees

### Industry Members

Mr. Jeff Zingsheim, IAC Chair, SysLogic  
Mr. Dave Neuman, Brady Corporation  
Mr. Keyur Khambholjia, Direct Supply  
Mr. Lon Bushweiler, Plexus  
Mr. Bryce Ferguson, Collins Aerospace  
Mr. Tom Kraus, GE Healthcare  
Mr. Joe Izzo, Rockwell Automation (ret), Consultant  
Mr. Joel Rondeau, Cognex

### Student Representatives

Ms. Jessica Flock, '19  
Mr. Paul Scarbrough, '19  
Mr. Thomas Burbach, '20  
Mr. Jack Haek, '22  
Ms. Joy Cross, '22

### Faculty

Ms. Deborah Varnell  
Dr. Adam Livingston  
Dr. Russ Meier  
Dr. Steve Williams, EECS Dept. Chair  
Dr. Darrin Rothe, Interim Program Director

Minutes recorded by Darrin Rothe

## Welcome and Introductions

IAC Chair Jeff Zingsheim called the meeting to order at 8:30 am. All members present were asked to introduce themselves.

### Approval of Previous Minutes

Previous minutes were approved with minor corrections.

One brief discussion ensued regarding best ways to communicate with current students and alumni regarding program news. Would additional presence on social media be beneficial? What platform? The committee was supportive of the idea and some suggested having a LinkedIn presence might be

useful. (editing note: some exploration of creating a program account on LinkedIn took place. While most universities (including MSOE, of course) have a presence, not many examples of a sub-entity such as a department or program were found. No further action taken).

## CE Program Updates

Predicted fall enrollment numbers are down slightly from AY18, but still solid.

Steve Williams shared some thoughts of trends that are being seen, along with impact of our new CS program. He has also done benchmarking with other institutions, and MSOE is performing well in that regard.

Russ Meier mentions that first to second year retention is always being watched and some tweaks were made to the first-year CE sequence that may be showing improved retention.

MSOE will be hosting a visiting Fullbright Scholar from St. Petersburg next year. That individual has a background in psychoacoustic modeling and may teach courses open to CE students.

Mention was made regarding our exchange program, with three CE students currently in Prague, and one in New Zealand.

Retention in the CE program remains a concern and is being watched by CE faculty. Keyur Khambholjia asked why there were not more students participating in exchanges, and what impediments exist. Jack Haek felt that airfare costs were perceived as being an impediment and that a scholarship for the programs may help boost participation.

## Membership Updates

The following membership updates were disclosed:

- Ian Atkinson may step back from committee due to continued inability to attend meetings
- Sam Aspinwall, student member, passed away
- Jessica and Paul are graduating tomorrow
- Keyur Khambholja, Direct Supply, will be taking over for Charles Fastner
- Joel Rondeau, Cognex, will be taking over for Mark Keup

## CE Program Events

A number of recent, upcoming, and ongoing events related to the CE Program as outlined in the agenda were disclosed with some minor discussion. A few items to note:

MSOE is always open to working with industry sponsors for senior design projects. Tom Kraus asked what the timeline was for sponsors. Darrin Rothe responded that teams are usually formed in April for the upcoming academic year. Steve Williams pointed out that a new position was formed in the Vice President of Academics office for industrial relations, and that person, Laura Schmidt ([schmidtl@msoe.edu](mailto:schmidtl@msoe.edu)), would be the proper point of contact for sponsorships.

Russ Meier noted that the IEEE student chapter is very active and open to a variety of interactions with industry.

## CE Senior Survey

At this point, Darrin Rothe began presenting the results of the annual senior survey administered to students graduating within the following year, with most respondents graduating this term. A variety of discussions ensued with the following noted:

Keyur Khambholjia asked if there are industry benchmarks for the various outcomes and what are our goals. Russ Meier said there were not industry-wide benchmarks and that we set our own goals. We also compare results from year to year to identify problem areas.

Dave Neuman asked where soft skills are being emphasized. Jessica Flock stated this is primarily in the freshman year, but those skills are often forgotten in later years when they would be most useful. Keyur Khambholjia stated they should be practiced in all courses. Tom Kraus noted that they likely are, but do not realize it. Dave Neuman gave examples of resume writing, where you must combine soft and hard skills. Jeff Zingsheim mentioned that a skills matrix is sometimes used when hiring to identify candidates with strong technical skills but with difficulty communicating.

Keyur Khambholjia suggested outcome e (ability to identify, formulate, and solve engineering problems) may be the most important of the ABET outcomes. Dave Neuman suggested that perhaps surveying the IAC could give perspective on the relative importance of each of the outcomes. Many felt outcome f (professional and ethical responsibility) was critical. Russ Meier acknowledged that we could do a better job in that area.

Lon Bushweiler asked if there would be value in conducting the survey to all years, thus tracking progress of each cohort and spotting trends. Steve Williams noted that it is not an outcomes-based curriculum, and any given course does not directly communicate ABET outcomes.

Outcome i (lifelong learning) was noted by Darrin Rothe as being particularly difficult to express in the curriculum as well as assess. Keyur Khambholjia mentioned that this is one area that the IAC could possibly help.

Dave Neuman inquired as to what sorts of probability and statistics were associated with outcome l. We may need to remind students what this means when they are taking the survey. Others echoed that there may be other opportunities in the area. Tom Kraus suggested risk assessments are related. Russ Meier noted that we could integrate that topic into embedded systems. Tom Kraus added security aspects also present as risk assessment. Keyur Khambholjia mentioned test-driven development, cost of writing tests, risks of testing or not testing, and other safeguards. Russ Meier noted that it might be worthwhile to reach out to industry to see what the current practice in this realm is. Keyur Khambholjia noted that it helps greatly having professors working in industry.

## Curriculum Topics

A brief overview of the current curriculum track ensued, with a couple of recent changes noted:

- Calc III and Calc IV revised, new course numbers
- CS3210 prerequisite relaxed
- Elective language revised

Russ Meier posed the question of whether the science elective should go back to requiring CH200. The committee as a whole responded with the opinion to keep it as an elective for maximal student flexibility. Adam Livingston mentioned that some physics electives of most interest to CE students do not run frequently. Russ Meier mentioned that we should, as a program, reach out to the physics department to communicate our preferences. Dave Neuman mentioned that there are two types of science courses – those tailored to a curriculum, and those intended to be supplemental. Tom Kraus noted that it would be nice if the course catalog stated what courses were offered for which programs so students can have a better idea when the course will run.

A rundown of technical electives planned for AY19 was presented. Keyur Khambholjia asked about topics in EE4930, Darrin Rothe responded with a few topics to the best of his knowledge (using an RTOS, low power modes), and Keyur suggested those topics should be required in the CE curriculum. Darrin mentioned that they are to some extent, but felt this course, actually an EE course, would represent enough additional material to qualify as a technical elective.

Jeff Zingsheim inquired what the UX minor entailed. The minor's catalog entry was reviewed.

Adam Livingston added that CE4800 Advanced Digital Design is intended to use Verilog as opposed to VHDL.

## Additional Discussion

An open discussion then followed.

Jeff Zingsheim asked how many hours of classroom time is used to teach C, stated that in his era, students largely picked it up on their own. Russ Meier said that feedback from our operating systems course is that students are not picking up advanced topics like pointer and memory management on their own and struggle when these skills are needed. Dave Neuman agreed that knowledge of memory management seems like one of the biggest demarcations between SE and CE students. Industry is also seeing less self-learning. Adam Livingston noted that our CE students start in assembly language and are managing memory from day one. It is being covered. Tom Kraus also noted that this discussion comes up at every IAC meeting. Deborah Varnell mentioned that we do not have our own first-year programming sequence, instead we use the Java-based sequence also used by SE and CS. Keyur Khambholjia asked why not, and why not in C? Darrin Rothe outlined the advantages of the current system, and that while not ideal for the reasons stated, keeps our students on track to take SE and CS-centric elective that might otherwise have long prerequisite strings.

## Adjournment

The meeting was adjourned at 11:00 am. Most committee members stayed onsite to attend the senior design show.



CE IAC Spring  
2019 Meeting

# Welcome and Introductions

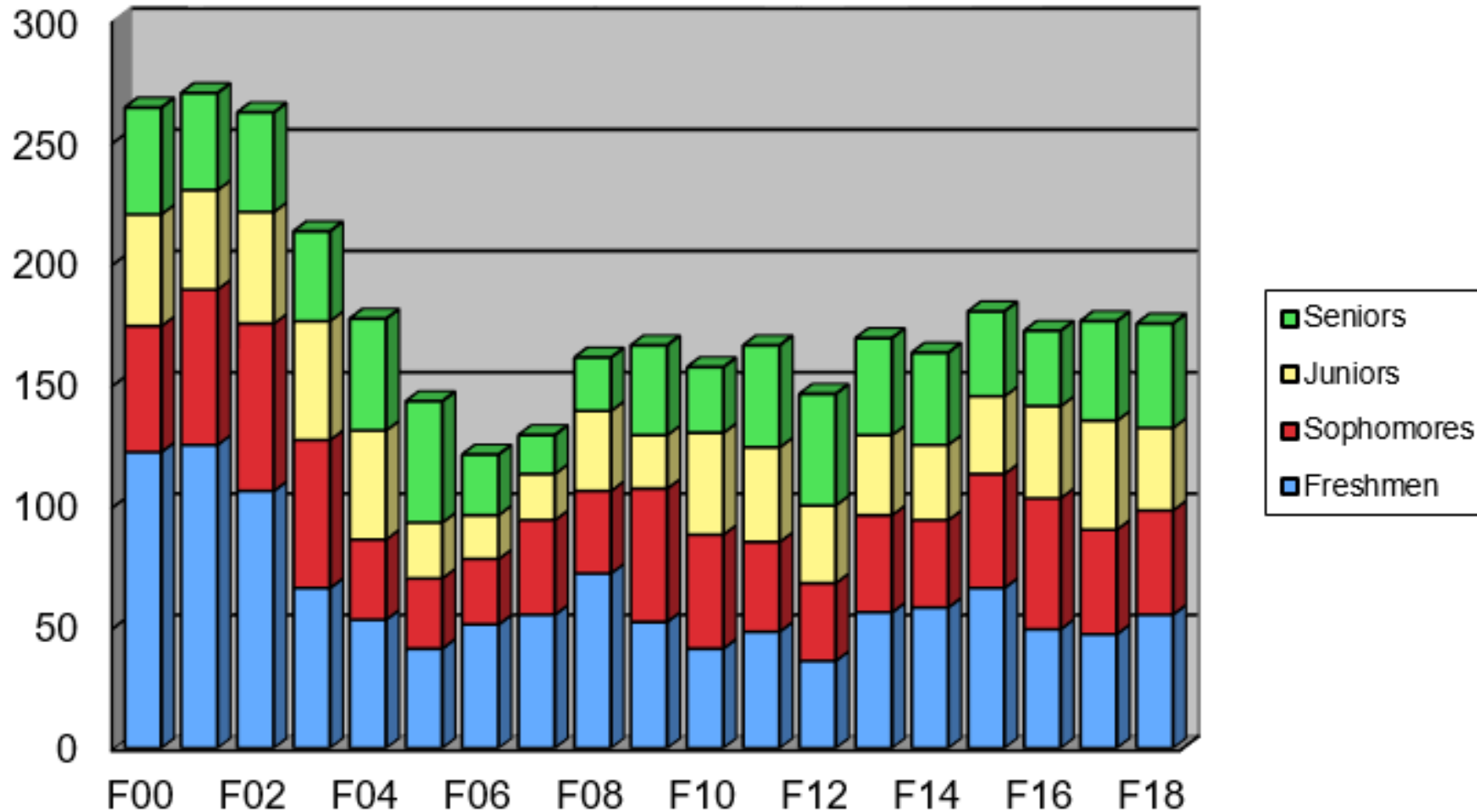


- Welcome – Jeff Zingsheim
- Approval of previous minutes (in folder)

# Program Updates – Total Enrollment



## CE Class Size Each Fall



# Program Updates – Graduating Seniors

	Freshmen	Sophomores	Juniors	Seniors	Total	Degrees	
<b>F00</b>	122	52	46	44	<b>264</b>	<b>35</b>	
<b>F01</b>	125	64	41	40	<b>270</b>	<b>35</b>	
<b>F02</b>	106	69	46	41	<b>262</b>	<b>38</b>	
<b>F03</b>	66	61	49	37	<b>213</b>	<b>37</b>	
<b>F04</b>	53	33	45	46	<b>177</b>	<b>45</b>	
<b>F05</b>	41	29	23	50	<b>143</b>	<b>42</b>	
<b>F06</b>	51	27	18	25	<b>121</b>	<b>22</b>	
<b>F07</b>	55	39	19	16	<b>129</b>	<b>13</b>	
<b>F08</b>	72	34	33	22	<b>161</b>	<b>18</b>	
<b>F09</b>	52	55	22	37	<b>166</b>	<b>26</b>	
<b>F10</b>	41	47	42	27	<b>157</b>	<b>21</b>	
<b>F11</b>	48	37	39	42	<b>166</b>	<b>30</b>	
<b>F12</b>	36	32	32	46	<b>146</b>	<b>32</b>	
<b>F13</b>	56	40	33	40	<b>169</b>	<b>33</b>	
<b>F14</b>	58	36	31	38	<b>163</b>	<b>26</b>	
<b>F15</b>	66	47	32	35	<b>180</b>	<b>27</b>	
<b>F16</b>	49	54	38	31	<b>172</b>	<b>23</b>	
<b>F17</b>	47	43	45	41	<b>176</b>	<b>28</b>	
<b>F18</b>	55	43	34	43	<b>175</b>	<b>33</b>	<- May 2019 only
				<b>Total Degrees →</b>		<b>564</b>	
<b>F18 Dual Majors</b>		2	2	4			



# Program Updates – Fall Enrollment

<b>F10</b>	41	47	42	27	<b>157</b>	<b>21</b>	
<b>F11</b>	48	37	39	42	<b>166</b>	<b>30</b>	
<b>F12</b>	36	32	32	46	<b>146</b>	<b>32</b>	
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				<b>Total Degrees →</b>		<b>564</b>	
<b>F18 Dual Majors</b>		2	2	4			

- “Official” prediction for Fall 2019:

	Traditional	Transfer	International
BME	50	3	0
CPE	44	2	1
CS	68	4	2
EE	45	5	1
EEX	na	17	na
SE	40	0	3

# Program Updates - Retention



- Not “official” data:
  - CE1921 (Spring Freshman CE-only): 54 enrolled (includes some upper-class)
  - CE2801 (Fall Sophomore CE-only): 45 enrolled, 7 freshmen not yet registered

# Program Updates – Foreign Exchanges



- Three sophomore CE students in Prague
- One junior CE student in New Zealand
  
- Good interest for next year

# CE IAC Membership Updates



- Please welcome:
  - Keyur Khambholja, Direct Supply
  - Joel Rondeau, Cognex

# Events - Recent

- **Op Computer Competition: another record – 67 teams (11/16/2018)**
- **Open Houses (10/20/18, 4/27/19)**
- **Accepted Student Days (numerous dates)**
- **Rockwell Collins-sponsored EECS Student Event (12/4/18) and Tour (12/7/18)**
- **JCI-sponsored CE Student Event (3/18/19) ~ 80 students + sponsor, faculty, alumni**
- **Czech exchange info meeting for CE/AE/CM students (4/1/19)**

# Events - Upcoming

- **Open Houses (7/13/19, + fall dates)**
- **Diercks Hall Grand Opening (9/13/19)**
- **CE Student Event (tentative 9/17/19), no sponsor**
- **Career Fair (9/26-27/2019)**
- **IEEEXtreme 13.0 Competition (10/18-19/2019)**
- **Fall IAC Meeting and Tour, Sharp Packaging (fall, 2019)**
- **Op Computer Competition (Friday, 11/22/19)**
- **Rockwell Collins-sponsored EECS Student Event (TBD)**

# Events – Ongoing, Opportunities

- Senior project collaborations
- Interact with students? Work with IEEE, SSE?
- Invite CE (or other EECS) faculty to your site?

# Senior Survey Results

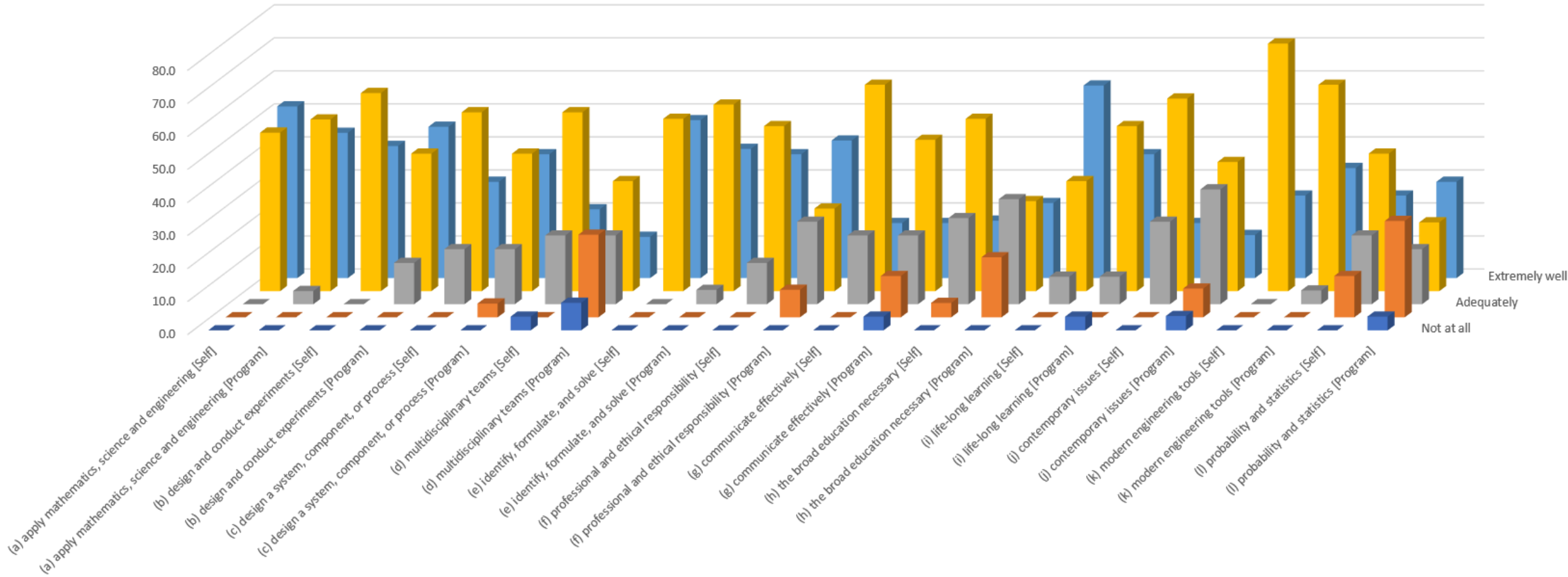


- Annual Event
- ~ 25 responses
- Difficulty with survey administration (Qualtrics)
- For each ABET outcome, students rate:
  - His/her achievement of outcome
  - Program's assistance in achieving outcome
- Scale – not at all, not very well, adequately, very well, extremely well

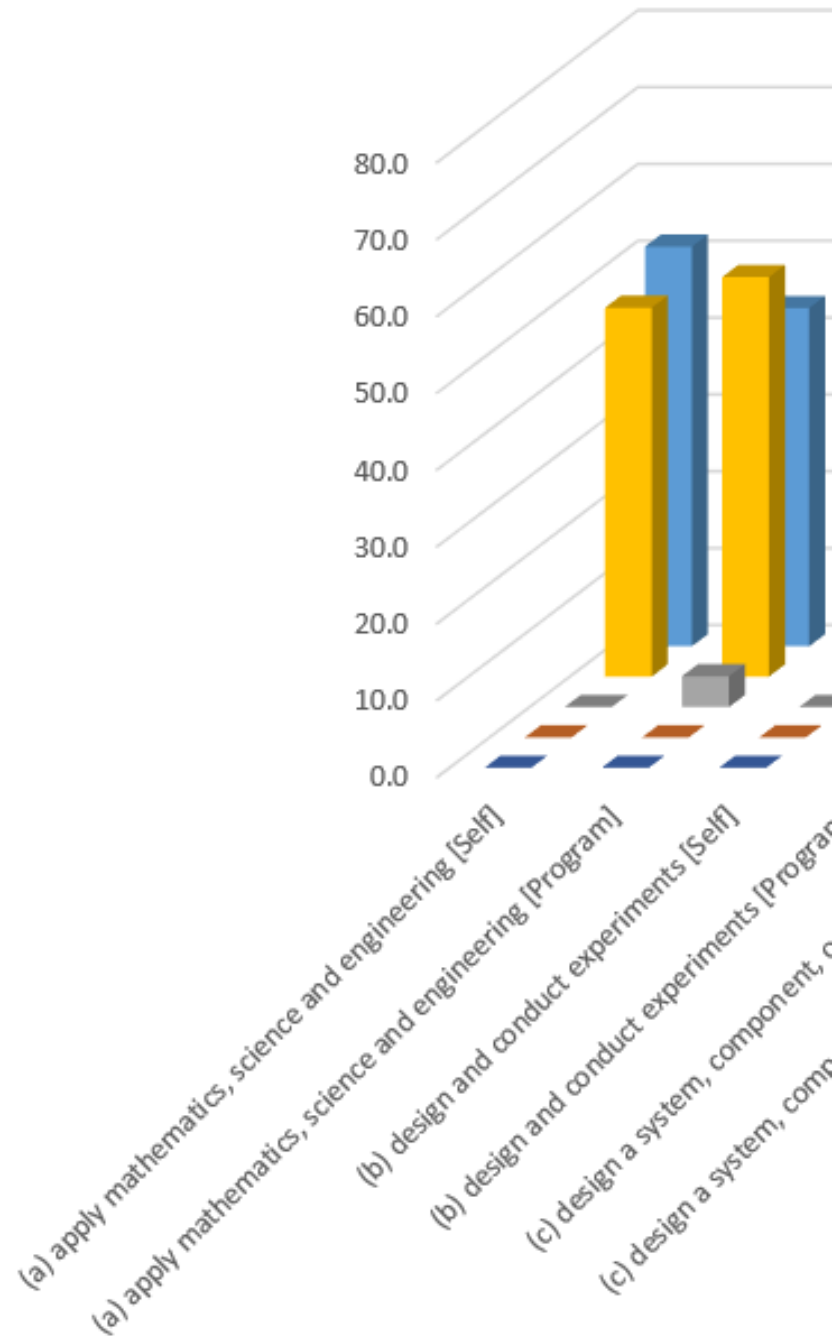


# ABET Outcomes

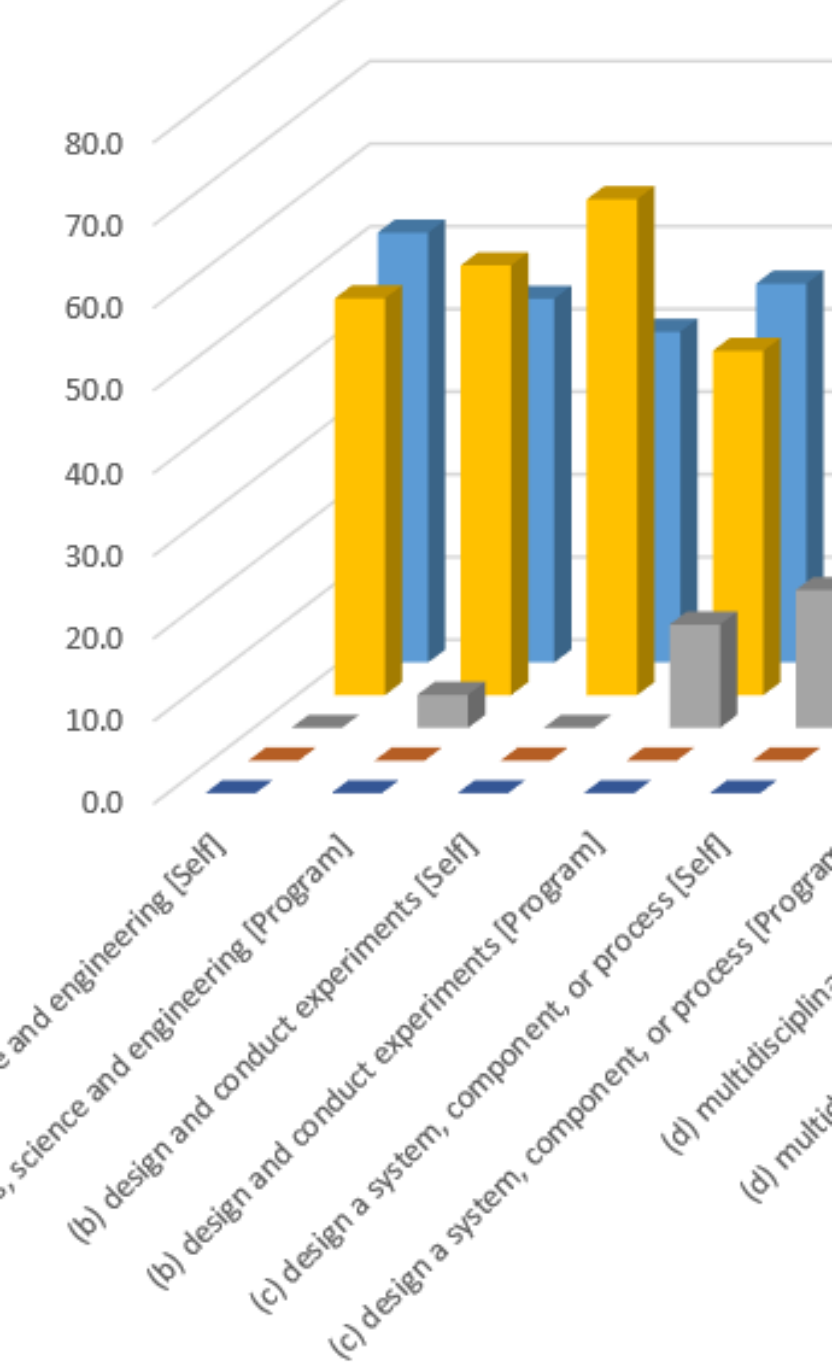
2019 CE Senior Survey - ABET Outcomes A-K + L, Individual Achievement and Program Assistance



(a) an ability to apply knowledge of mathematics, science and engineering

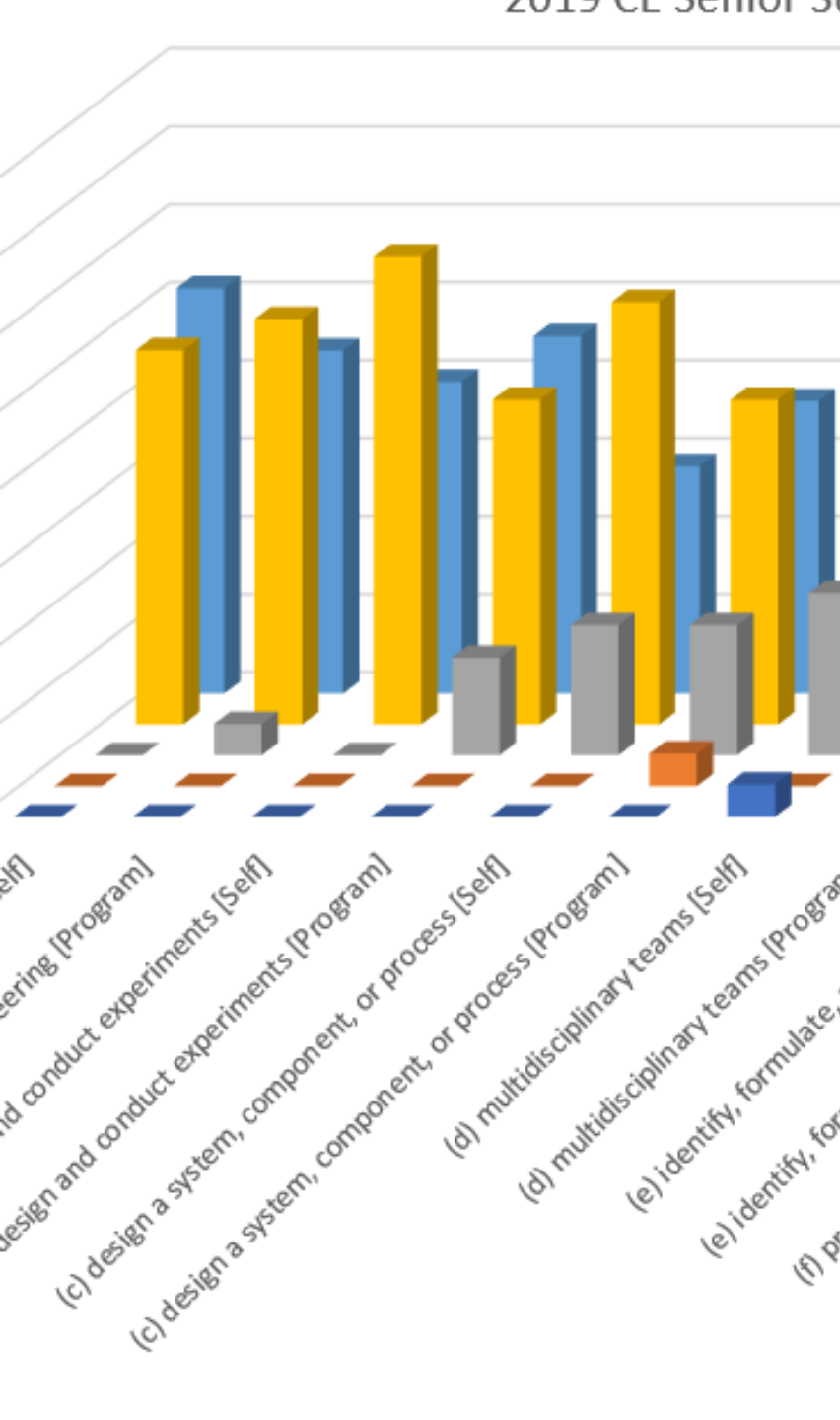


- Self – 4.5 avg
- Program – 4.4 avg



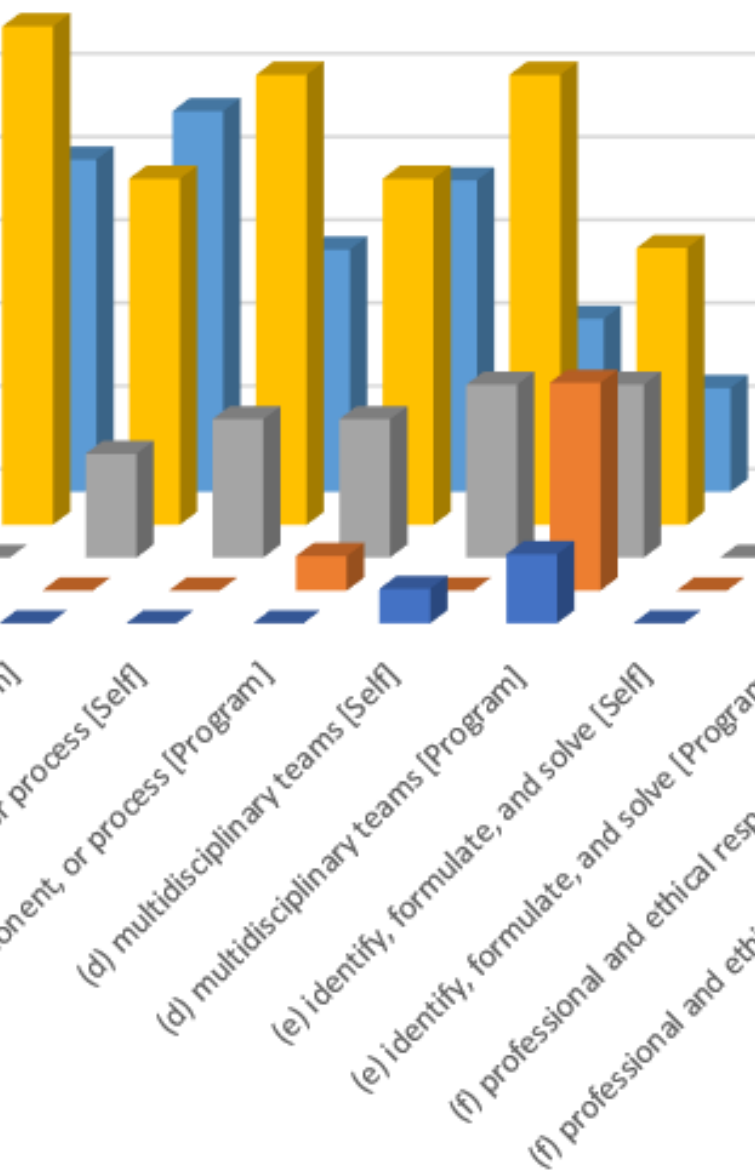
(b) an ability to design and conduct experiments, as well as to analyze and interpret data

- Self – 4.4 avg
- Program – 4.3 avg



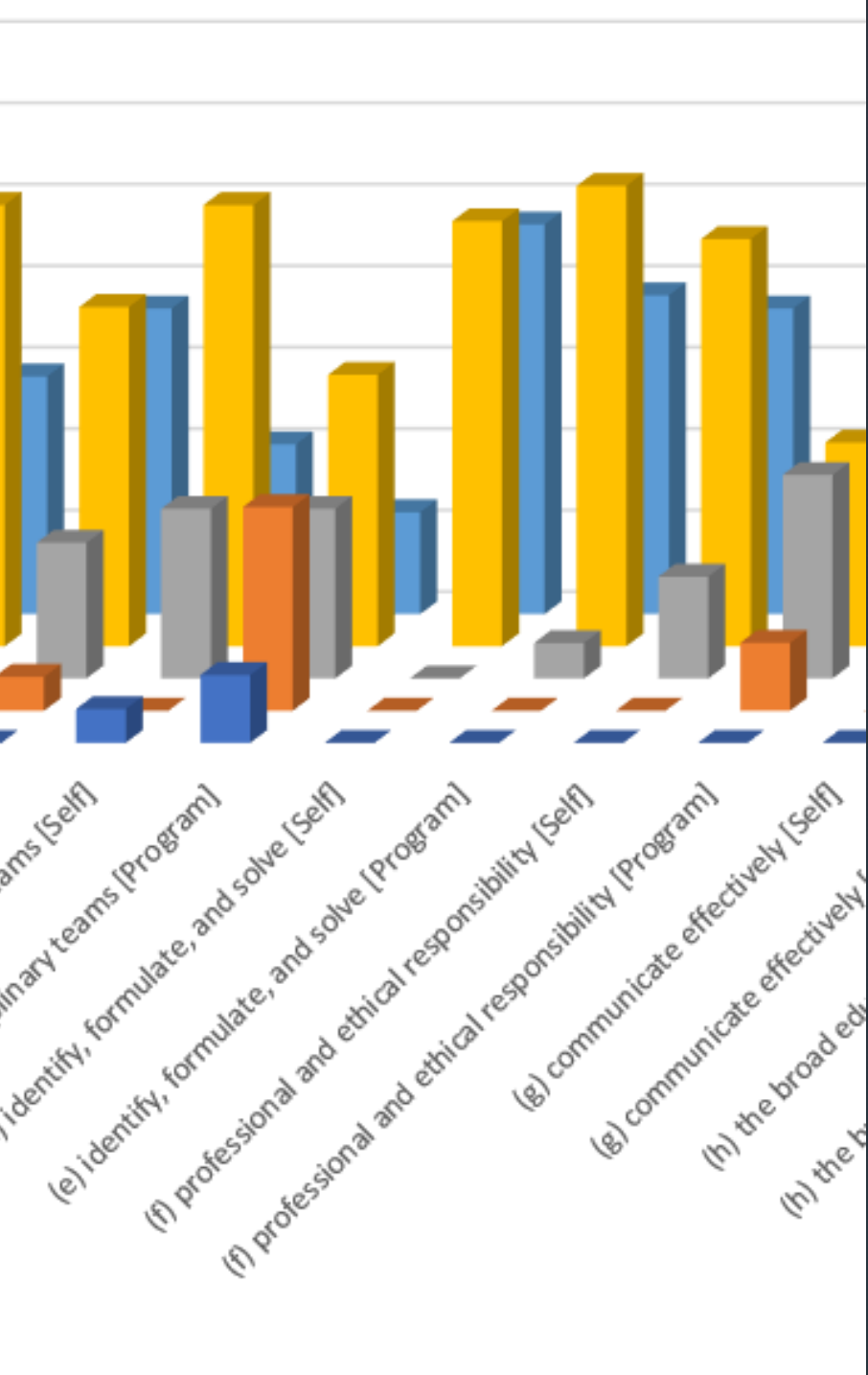
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

- Self – 4.1 avg
- Program – 4.1 avg



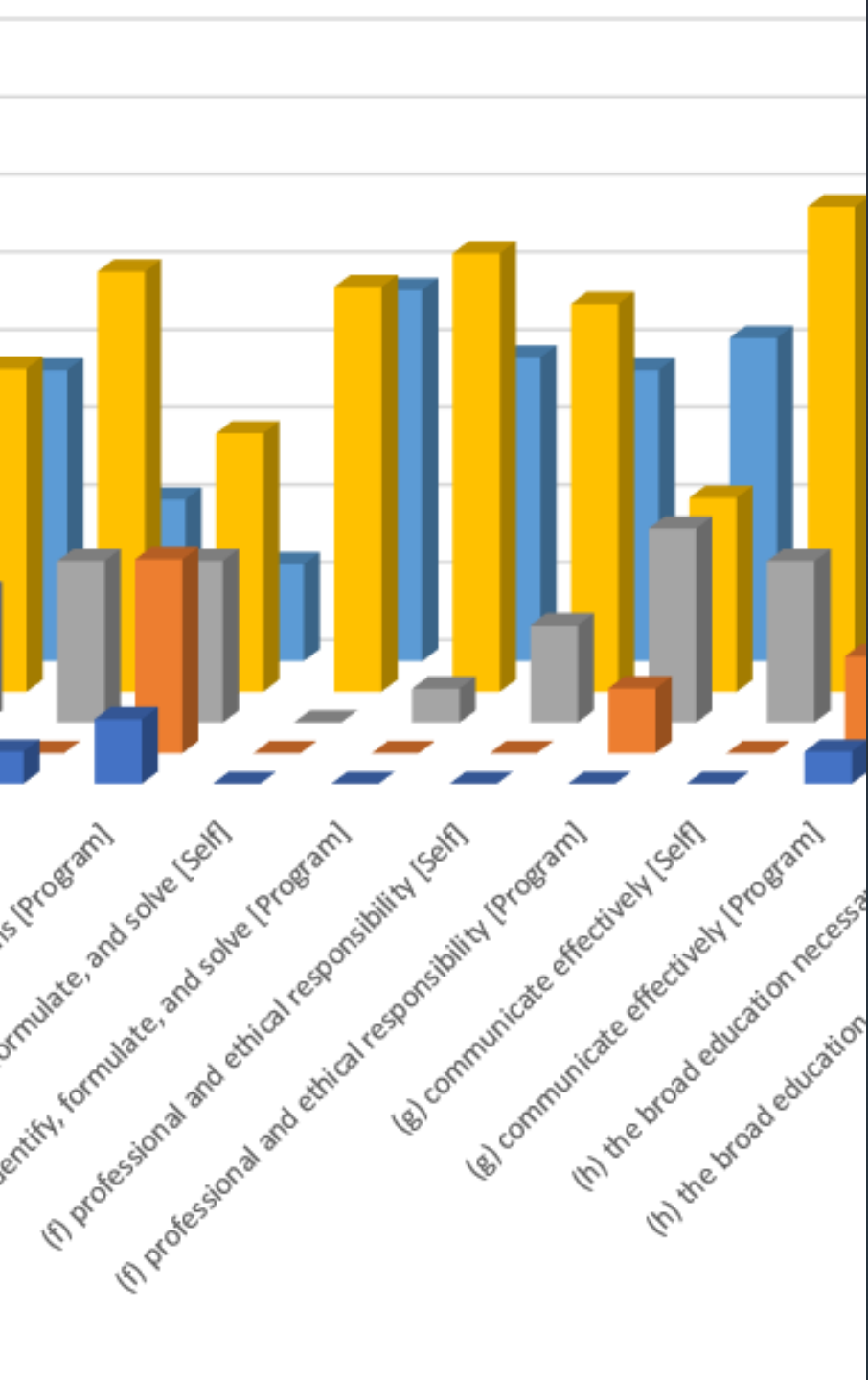
(d) an ability to function on multidisciplinary teams

- Self – 3.9 avg
- Program – 3.2 avg



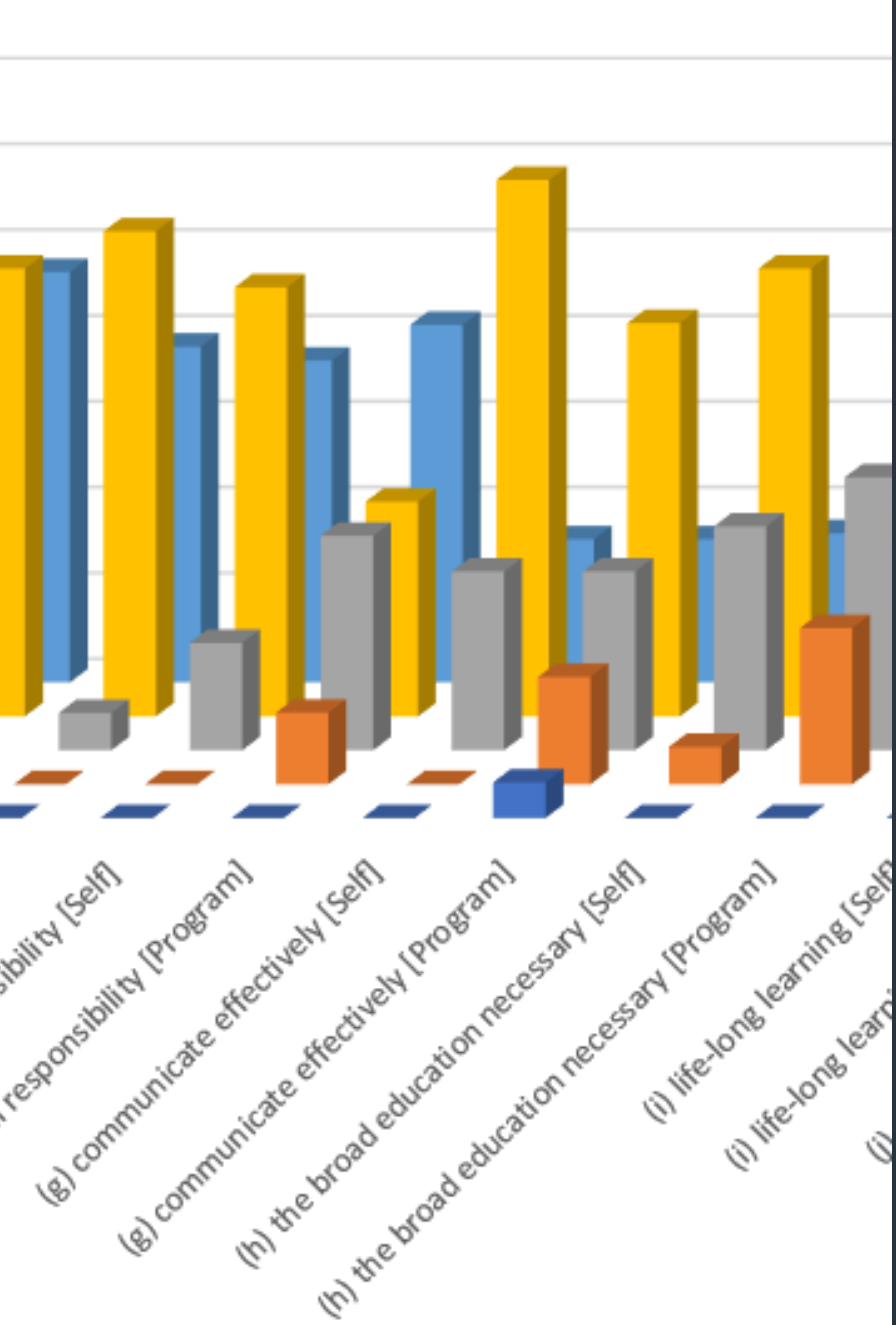
(e) an ability to identify, formulate, and solve engineering problems

- Self – 4.5 avg
- Program – 4.3 avg



(f) an understanding of professional and ethical responsibility

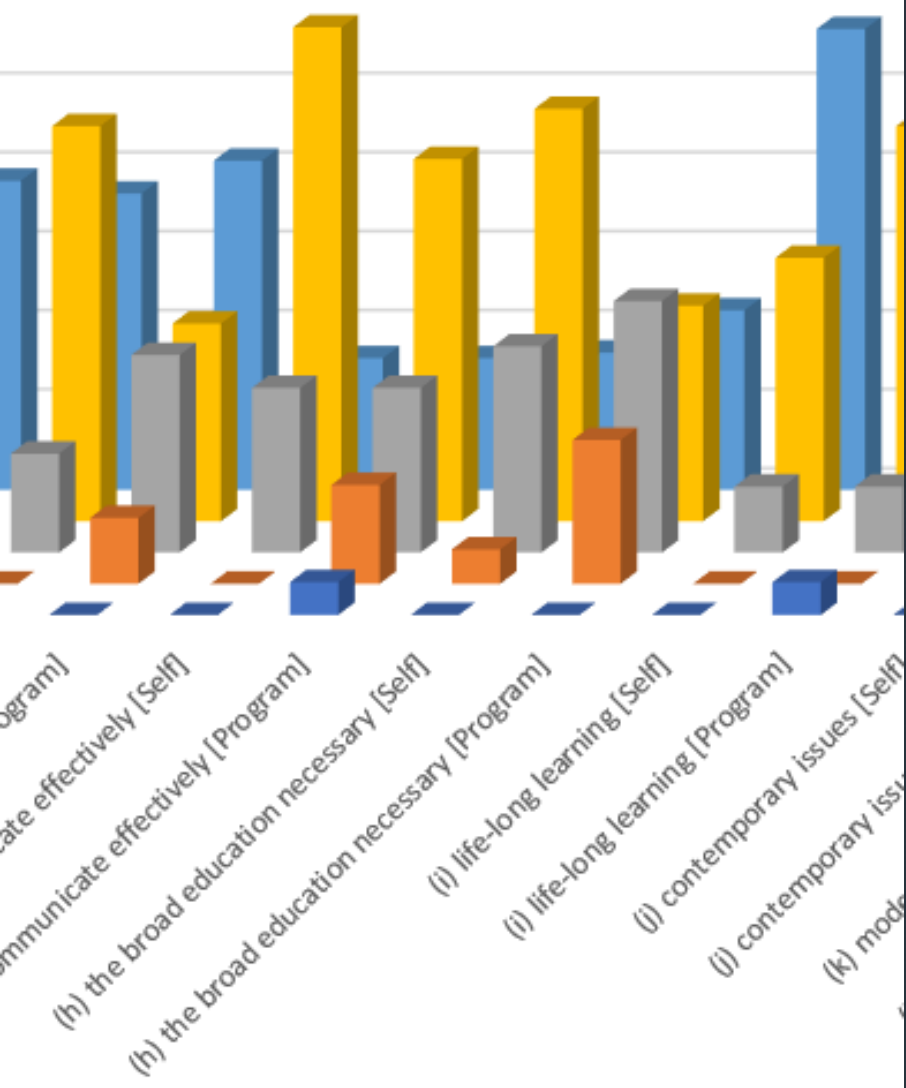
- Self – 4.3 avg
- Program – 4.0 avg



(g) an ability to communicate effectively

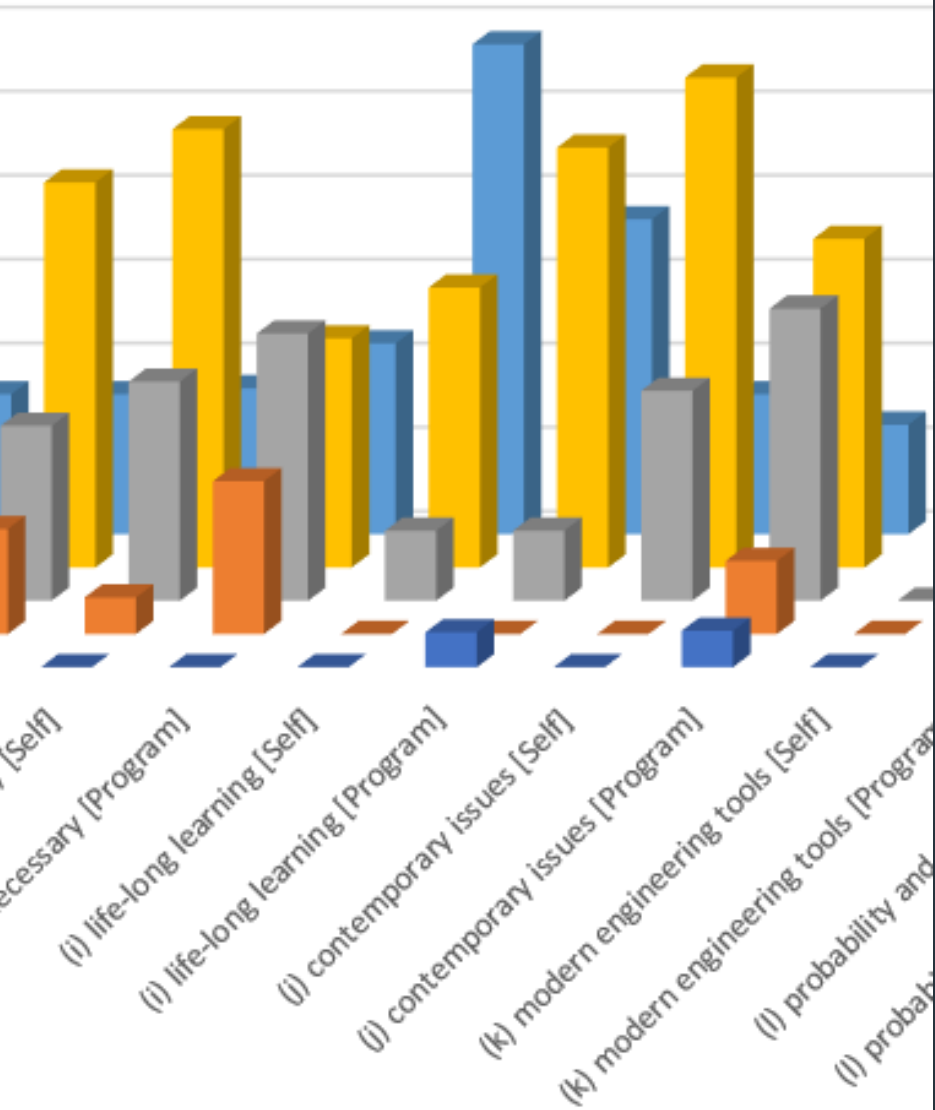
- Self – 4.0 avg
- Program – 3.6 avg





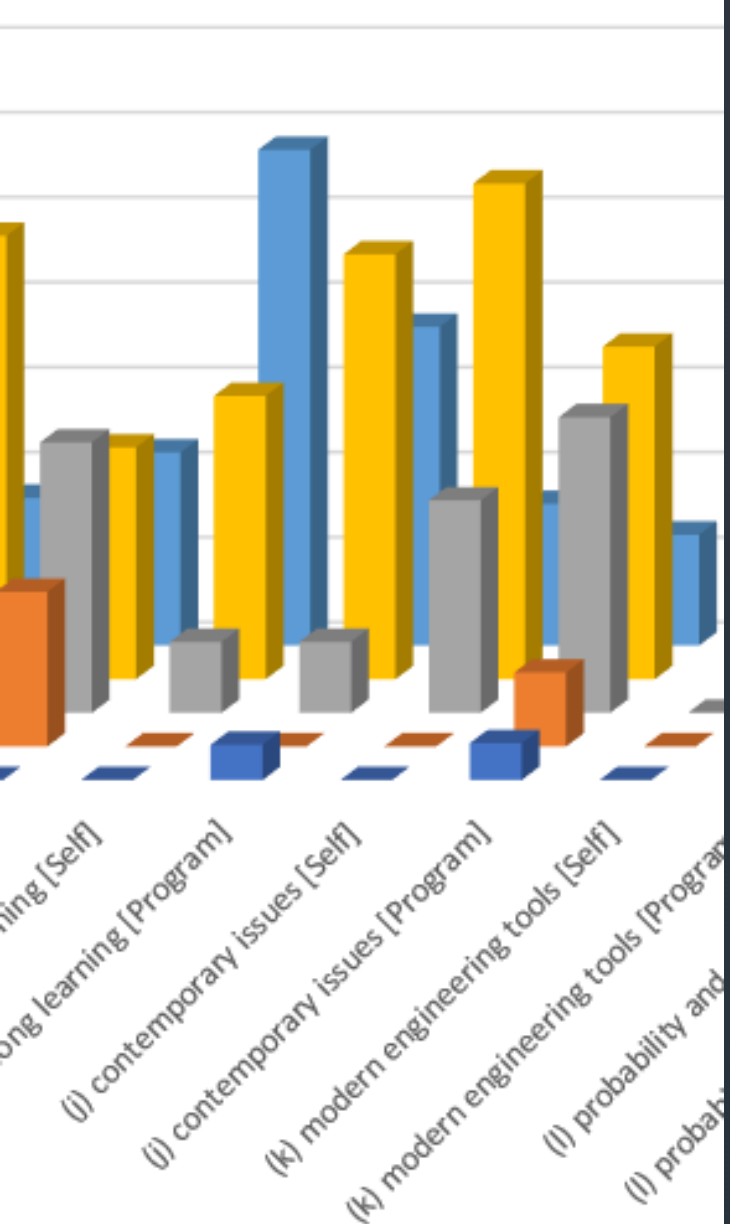
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

- Self – 3.8 avg
- Program – 3.5 avg



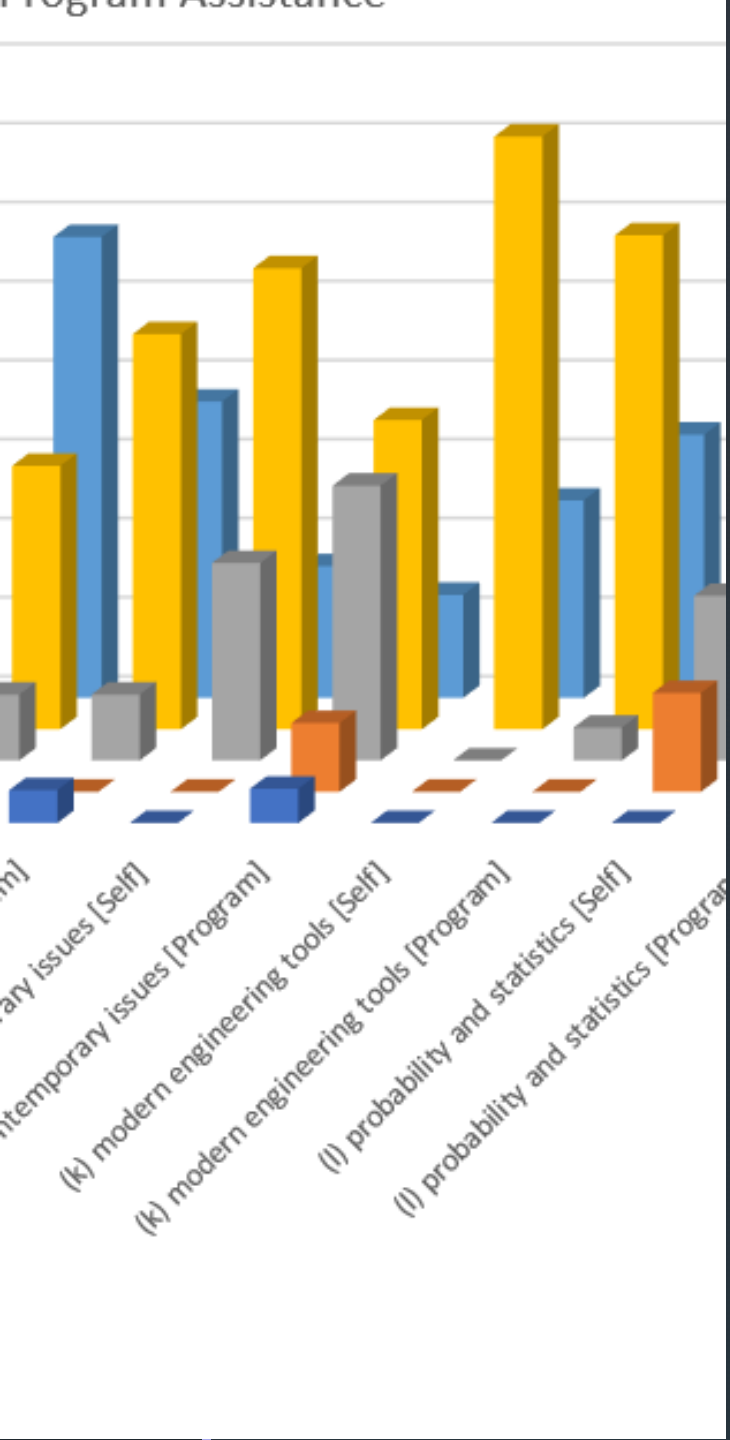
(i) a recognition of the need for, and an ability to engage in life-long learning

- Self – 4.5 avg
- Program – 4.2 avg



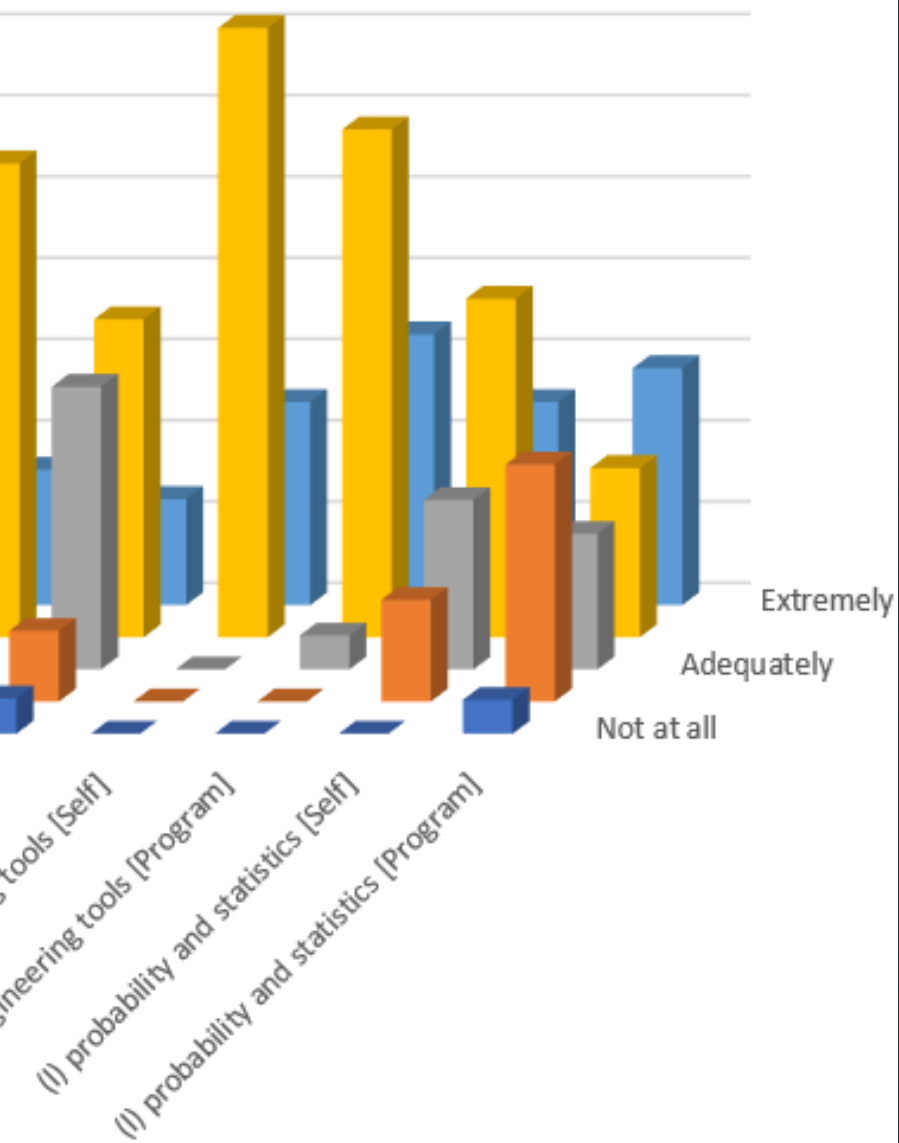
(j) a knowledge of contemporary issues

- Self – 3.9 avg
- Program – 3.5 avg



(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

- Self – 4.3 avg
- Program – 4.3 avg



(I) an ability to apply knowledge of probability and statistics to computer engineering

- Self – 3.8 avg
- Program – 3.4 avg

# ABET 2019-2020



- 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**
- 2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**
- 3. an ability to communicate effectively with a range of audiences**
- 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
- 5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
- 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions**
- 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**

# Additional Comments



- Curriculum
- Areas of Study
- Specific Courses
- Specific Professors
- Facilities
- Advising
- Logistics
- Choose MSOE again? ← mostly yes!

Generally positive!

# Student Member Comments





**Pause**



# Curriculum Topics - Core

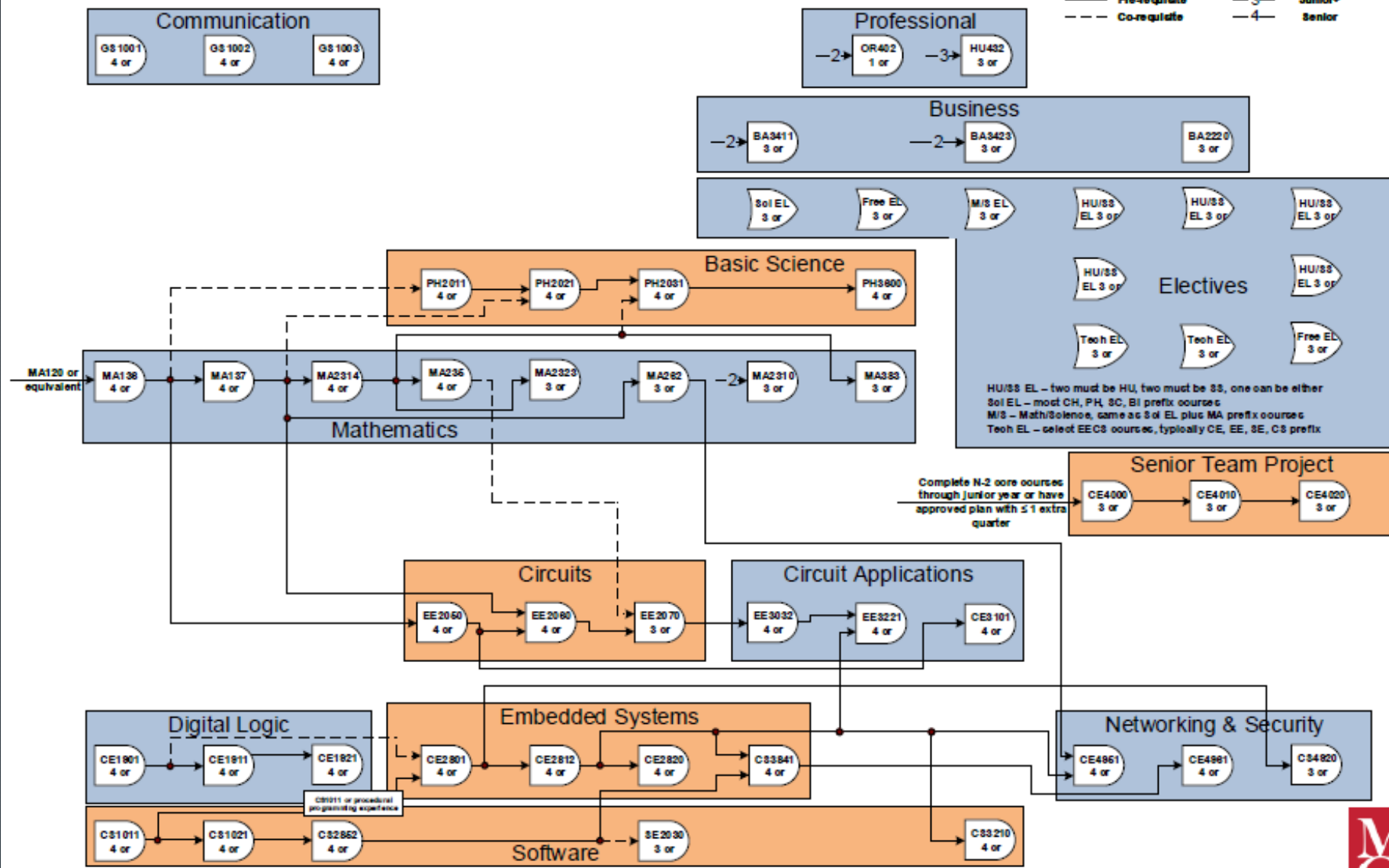
- Now have all four years in new 4x4-format curriculum; new networking courses ran, including required, updated CS4920
- Minor revision, now at v4.3.
  - Calc III and Calc IV revised.
  - Changed CS3210 pre-req.
  - Reworded elective language.

# Computer Engineering Curriculum Flow Chart

Version 4.3, for F'19 freshmen



- EL Elective
- Pre-requisite
- - - Co-requisite
- 2- Sophomore+
- 3- Junior+
- 4- Senior



Complete N-2 core courses through junior year or have approved plan with ≤ 1 extra quarter

Rev 01 3/8/2018

16 + 16 + 16 = 48

16 + 15 + 17 = 48

17 + 15 + 17 = 49

16 + 16 + 15 = 47



# Curriculum Topics – Electives 2018-2019

- Fall:
  - CS3860 (Databases, Dr. Urbain)
  - CS4981 (Data Science, Dr. Urbain)
  - SE4910 (Mobile App Development, Dr. Riley)
- Winter:
  - CE498 (Fault-tolerant Design, Dr. Meier)
  - CS4850 (Machine Learning, Dr. Urbain)
  - CS498 (Entrepreneurship in Computing/Engineering, Dr. Dennis)
  - EE484 (Neural Networks, Dr. Ross)
- Spring:
  - CE4100 (Embedded System Fabrication, Dr. Rothe)
  - EE423 (DSP Applications, Dr. Prust)
  - SE4940 Network Security Tools and Practices (Dr. Schilling)

# Program Topics – Electives 2019-2020

- CE4100 Embedded System Fabrication
- CS4981 Introduction to Data Science
- CS4850 Machine Learning
- CE4930 Computer Architecture II
- SE3830 Human Computer Interaction
- EE4930 Advanced Embedded Systems
- CE4800 Advanced Digital Design

# General Discussion



- Strategic initiatives? What is next?
  - Trends in Computer Engineering
  - How can we take advantage of new CS program, resources?
  - Maintain “alignment” with SE, CS, EE?
- Better freshman experience?
- Time for a major revision?
- Major or minor tweaks? Where?
  - Operating Systems
  - Graphics
  - Embedded Sequence
- Survey says – more C++? More C++ embedded? Where?