Prepared by the Engineering Student Council, Policy Committee
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A Detailed Breakdown of Employers Present at the Fall 2016 Engineering Career Fair and a Report on Student Perception of the Services Provided by the Center for Career Education

INTRODUCTION

The following report has been created as an educational resource on research that evaluates the employers brought on campus for the Fall Engineering Career Fair by engineering discipline, to ascertain whether the population of Columbia Engineers is being adequately liaised with engineering, research, and technology firms.

In addition, the report evaluates student perception of the Center for Career Education (CCE)'s services on whole.

METHODS

Career Fair Audit

In total, 110 companies came to the Fall 2016 Engineering Career Fair at Columbia University. The jobs available at each company were ascertained via each company's respective job application portal and "about" page. Companies were given up to five tags each, corresponding to the type of jobs available at each firm. Relevant tags were chosen from commonly-pursued majors within Columbia Engineering. Eleven tags total were used and they are listed below:

1. Biomedical Engineering
2. Chemical Engineering
3. Civil Engineering
4. Computer Engineering
5. Computer Science
6. Electrical Engineering
7. Environmental Engineering
8. Marketing/HR
9. Materials Science
10. Mechanical Engineering
11. Operations Research

Ten of the 110 companies were not assigned tags due to incomplete data on their webpages.

Two analyses were conducted. The first analysis assumed that each firm had one job available to new graduates. The second analysis assumed that each firm had a number of jobs proportional to firm size available to new graduates.

> Analysis 1 normalized each tag for each firm by the total number of tags for each firm. For example, if a firm had one tag (Biomedical Engineering), the tag would get a normalized value of 1. However, if a firm had three tags (e.g. Biomedical Engineering, Computer Science, and Chemical Engineering), each tag would get a normalized value of ⅓. Finally, the normalized tags were summed across all firms.

> Analysis 2 normalized each tag for each firm by the total number of tags for each firm, as before. These normalized tags were then weighted (by multiplication) by the relative size of the firm, as estimated by Glassdoor.com. Finally, the normalized tags were summed across all firms.

Figure 1 shows a simplified schematic of the analysis with only four firms, three tags, and two fields, for simplicity's sake.

(a) Example Analysis 1

Firm	Field 1	Field 2	Weight	Tag 1	Tag 2	Tag 3	Sum of Tags	W Tag 1	W Tag 2	W Tag 3
Firm 1	Tag 1	Tag 2	1	1	1	0	2	0.5	0.5	0
Firm 2	Tag 1		1	1	0	0	1	1	0	0
Firm 3	Tag 1		1	1	0	0	1	1	0	0
Firm 4	Tag 3	Tag 2	1	0	1	1	2	0	0.5	0.5
						Sum of Weighted Tags:		2.5	1	0.5

(b) Example Analysis 2

Firm	Field 1	Field 2	Weight	Tag 1	Tag 2	Tag 3	Sum of Tags	W Tag 1	W Tag 2	W Tag 3
Firm 1	Tag 1	Tag 2	10	1	1	0	2	5	5	0
Firm 2	Tag 1		50	1	0	0	1	50	0	0
Firm 3	Tag 1		100	1	0	0	1	100	0	0
Firm 4	Tag 3	Tag 2	20	0	1	1	2	0	10	10
						Sum of Weighted Tags:		155	15	10

Figure 1. Examples of analytical methodology

Finally, the sum of weighted tags for both analyses was compared to the number of SEAS students graduating in each engineering discipline in 2016 in order to assess under- and over-represented disciplines at the Engineering Career Fair.

Student Survey

A survey entitled, "Resources Available @ the Center for Career Education (CCE)" was commissioned by the Engineering Student Council (ESC). The survey had the following description:

> In order to help the Center for Career Education (CCE) better allocate their resources, the Engineering Student Council requests your participation in the linked survey regarding student preference in resources that are currently available.
>
> The results for this survey will be made public, but all private information will be withheld. (Per ESC Resolution Fall 2016: http://bit.ly/ESCSurveyPolicy)

The following information was solicited from survey participants:
1. Basic demographic data including school, class year, and major
2. A ranking of CCE's resources in order of utility
3. General commentary on CCE's resources

The survey was sent out on Facebook and via listservs to the general undergraduate SEAS community. Students were also encouraged to fill out the survey at the Tree Lighting ceremony, an event co-hosted by ESC's Student Life committee on 1 December 2016. It should be noted that Sid Perkins' computer was used for this, so each response submitted on 1 December 2016 is attributed to his UNI.

RESULTS

All results are up to date as of 12 pm, December 4th, 2016.

Career Fair Audit

The results of Analysis 1 can be found in Table 1 and Figure 2 below.

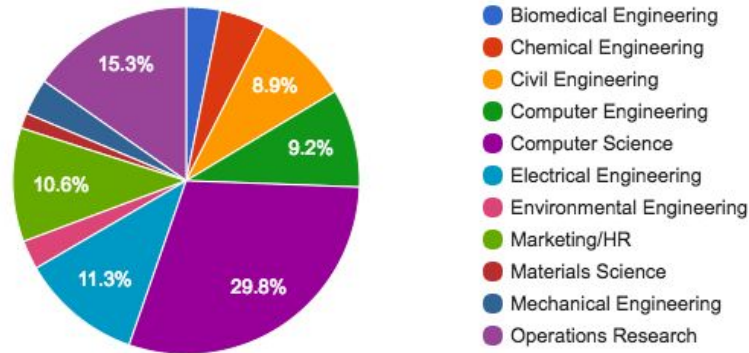| Discipline	Sum of Weighted Tags	Percent
Biomedical Engineering	3.17	3.17
Chemical Engineering	4.33	4.33
Civil Engineering	8.92	8.92
Computer Engineering	9.17	9.17
Computer Science	29.75	29.75
Electrical Engineering	11.28	11.28
Environmental Engineering	2.70	2.70
Marketing/HR	10.58	10.58
Materials Science	1.45	1.45
Mechanical Engineering	3.37	3.37
Operations Research	15.28	15.28

Table 1. Analysis 1 results

Figure 2. Analysis 1 results, showing the sum of weighted tags for each tag across all firms

The results of Analysis 2 can be found in Table 2 and Figure 3 below.

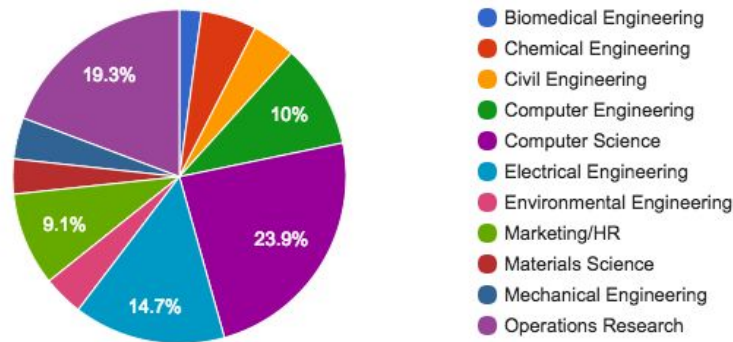| Discipline	Sum of Weighted Tags	Percent
Biomedical Engineering	8055.00	2.13
Chemical Engineering	20375.00	5.40
Civil Engineering	15833.33	4.19
Computer Engineering	37891.67	10.04
Computer Science	90177.50	23.88
Electrical Engineering	55583.33	14.72
Environmental Engineering	14750.00	3.91
Marketing/HR	34179.17	9.05
Materials Science	12750.00	3.38
Mechanical Engineering	15133.33	4.01
Operations Research	72841.67	19.29

Table 2. Analysis 2 results

Figure 3. Analysis 2 results, showing the sum of weighted tags for each tag across all firms
Table 3 and Figure 4 show the breakdown of SEAS graduates by discipline, according to the SEAS website.[1]

Discipline	2016 SEAS Graduates	Percent
Biomedical Engineering	49	13.07
Chemical Engineering	38	10.13
Civil Engineering	43	11.47
Computer Engineering	0	0.00
Computer Science	70	18.67
Electrical Engineering	34	9.067
Environmental Engineering	12	3.20
Marketing/HR	0	0.00
Materials Science	7	1.87
Mechanical Engineering	57	15.20
Operations Research	65	17.33

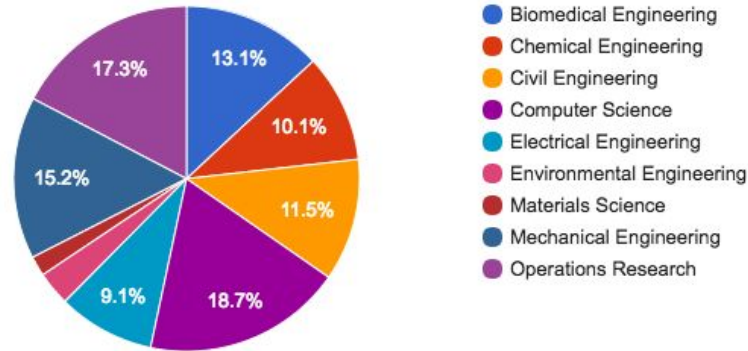**Table 3.** Class of 2016 SEAS Graduates by Tag

Figure 4. Class of 2016 SEAS Graduates by Tag

For Analysis 1 and Analysis 2, a representation score was computed by dividing the percent of weighted tags (corresponding to number of jobs) by the percent of students graduating with that major. These scores can be found in Figure 5. Scores lower than one indicate under-representation and scores higher than one indicate over-representation. Color scales have been added to the data table to correspond with under (red) and over (blue) -representation.

Discipline	Analysis 1: Representation Score (jobs/students)	Analysis 2: Representation Score (jobs/students)
Biomedical Engineering	0.24	0.16
Chemical Engineering	0.43	0.53
Civil Engineering	0.78	0.37
Computer Science	1.59	1.28
Electrical Engineering	1.24	1.62
Environmental Engineering	0.84	1.22
Materials Science	0.78	1.81
Mechanical Engineering	0.22	0.26
Operations Research	0.88	1.11

Figure 5. Representation scores for Analysis 1 and Analysis 2

Student Survey
In total, 78 people replied to the survey. 60.3% of survey participants were in SEAS, while 32.1% were in CC, 6.4% were in GS, and 1.3% were in Barnard.

The majority of students who responded to the survey were in the class of 2017, as can be seen below in Figure 6.
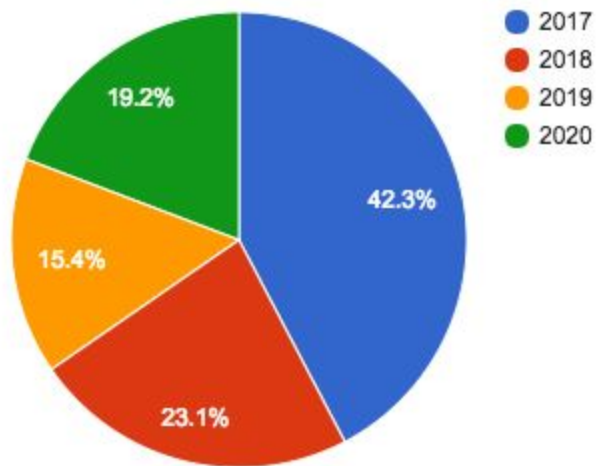
Figure 6. Survey participants by graduating class

A wide variety of majors responded to the survey. The majority of responses came from Biomedical Engineers, followed by Undeclared Engineers, Operations Researchers, and Computer Scientists. A summary of respondents by their majors can be found below in Figure 7.
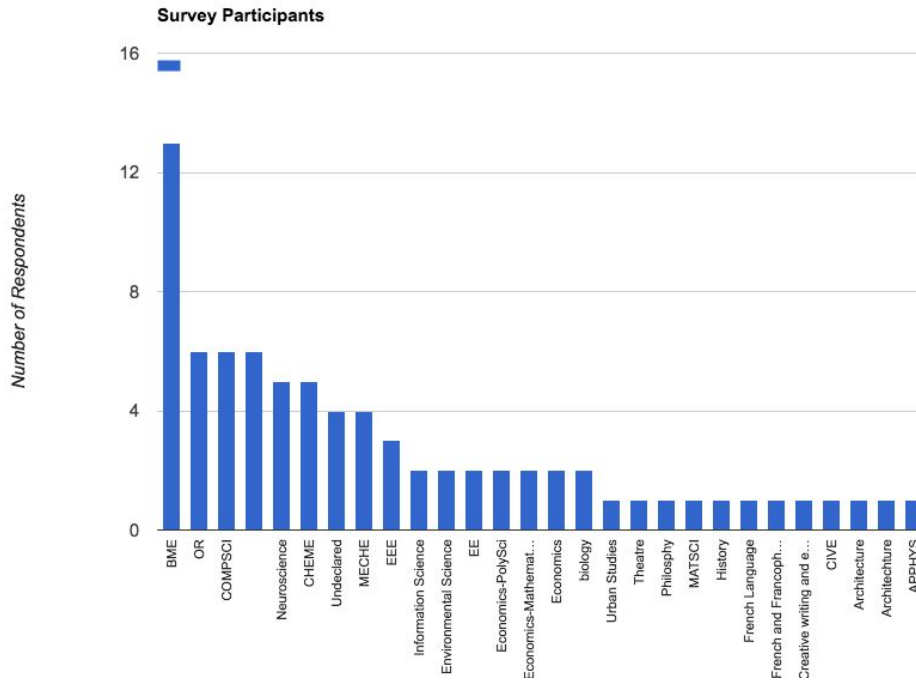
Figure 7. Survey participants by academic major

Survey respondents were asked to rank the below resources from 1 to 8 (with 1 being the most useful to 8 being the least useful). The results were averaged for all participants and the resulting ranking is shown below in Table 6.

Resource	Average Score
Career Fairs	4.08
LionSHARE (now Handshake)	4.14
Counseling	4.27
Alumni Affairs	4.70
Mock Interviews	4.76
Professional Development Workshops	4.93
Site Visits	4.97
Wardrobe Services	5.18

Table 6. Ranking of CCE resources from most useful (lowest average score) to least useful (highest average score)

Field	Score
OR	3.50
BME	4.23
CHEME	4.40
COMPSCI	4.67
MECHE	7.25

Table 7. Ranking of Career Fairs by selected majors

Finally, qualitative feedback was solicited through the survey. The responses are presented below in an anonymous format. All submissions are presented:

"Disclaimer: did not use wardrobe service, mock interviews, site visits, was not aware of alumni events"

"Walk ins are great. CCE does a fantastic job."

"The major related job listings are not relevant, and should get input from the department."

"Handshake needs to take note of graduation date. I keep getting suggestions that are for people who graduate in December or for PhD students so that's irritating."

"There is NOTHING the CCE offers in the way of careers beyond consulting, finance, and computer science, and it frustrates me to no end. Every time I see a posting for an "engineering" internship it's always CS. Literally every time. If the CCE ever tried actually serving the rest of us trying to get jobs in basically any other field, I wouldn't mind terribly."

"Lionshare/handshake is confusing"

"I haven't used most of these resources"

"Horrible at providing services for engineers"

"CCE's resources are grossly biased toward compsci/finance/consulting. This pushes folks who are doing things like biomedical engineering into less lucrative summer experiences often involving research. Not only is this unfair for students from underprivileged backgrounds, it also has a tendency to push many of our engineers into academia, even though they might have been more happy working in industry."

"I'm not sure if they do workshops on negotiating salaries but that kind of thing would be helpful!"

"I once asked for help with my resume, and all they helped with were synonyms for three or four words, which wasn't very helpful to the content of my resume."

"CCE has no knowledge in or services for my field (architecture), which is a shame given the graduate school here is #4 in the world"

"not great"

"Mock interviews are badly administered. I tried to get a practice consulting case interview in early september and the only slot open was after most of my interviews had ended."

"There doesn't seem to be a lot of diversity of fields represented in major events. I hope to go into education, and I don't even go to the Columbia career fairs, only Barnard ones."

"It'd be helpful if CCE could develop better recruiting relationships with more biotech and pharmaceutical companies."

"Help Urban Studies majors please! All of us aren't in finance or tech"

DISCUSSION

Career Fair Audit

The policy committee's findings presented above show a gross under-representation among biomedical, mechanical, civil, and chemical engineers at the Engineering Career Fair. This is evident in that the representation scores for these disciplines were lower than unity for both Analysis 1 and Analysis 2.

Given that environmental engineers, materials scientists, and operations research students were under-represented in Analysis 1 and over-represented in Analysis 2, one can conclude that a select few large companies (such as the City of New York's Department of Environmental Conservation and Alcoa) are providing these students with prospective jobs.

By far, computer scientists and electrical engineers receive the most representation from prospective employers, showing over-representation in both analyses.

Student Survey

The survey received more responses from students in SEAS than any other school. This makes sense given that the survey was administered by ESC. In the future, ESC will likely work harder to make it clear that non-engineers may contribute to this type of feedback. Support from the Columbia College Student Council could also help to broaden the reach of these analyses.

The survey received more responses from students graduating in 2017 compared with other graduating classes. It is probable that for these students the experience of working with CCE is most salient.

Students studying biomedical engineering, operations research, and computer science filled out the survey in greatest number, perhaps due to the fact that there are simply many students who study these three disciplines. However, this does not account for the disproportionately high number of biomedical engineers who filled out the survey (over OR and CompSci, see Table 3). The spike in biomedical engineering respondents might be attributable to a general discontentment among their demographic (see qualitative responses and Figure 5).

Students rated career fairs as being the most useful resource offered by CCE (Table 6). Biomedical, chemical, and mechanical engineers, as well as computer scientists all rated career fairs as being less useful than the average rating among all survey respondents. Notably, mechanical engineers felt that career fairs were particularly not helpful, consistent with their dramatic underrepresentation shown previously in Figure 5. Students studying operations research thought most highly of career fairs among the selected majors (Table 7).[†]

From the qualitative responses, it seems that many students believe there is over-representation among the computer science, finance, consulting, and tech industries, a sentiment not inconsistent with the results presented in Figure 5 ("There is NOTHING the CCE offers in the way of careers beyond consulting, finance, and computer science, and it frustrates me to no end.", "Help Urban Studies majors please! All of us aren't in finance or tech").

There were also responses pointing out CCE's lack of attention toward engineers in general ("Horrible at providing services for engineers", "CCE's resources are grossly biased toward compsci/finance/consulting. This pushes folks who are doing things like biomedical engineering into less lucrative summer experiences often involving research. Not only is this unfair for students from underprivileged backgrounds, it also has a tendency to push many of our engineers into academia, even though they might have been more happy working in industry.", "not great"). This finding may be consistent with the analysis presented above regarding a general dissatisfaction with career fairs among engineering respondents.

Some responses indicated a lack of knowledge of some of CCE's resources, reflecting opportunities for growth in the communication of these resources ("I'm not sure if they do workshops on negotiating salaries but that kind of thing would be helpful!", "Disclaimer: did not use wardrobe service, mock interviews, site visits, was not aware of alumni events").

Finally, it should be noted that some students responded positively, suggesting that CCE does a good job with walk-ins ("Walk ins are great. CCE does a fantastic job.").

ACKNOWLEDGEMENTS
ESC thanks all of those who participated in the survey.

WORKS CITED
1.   Office of Planning and Institutional Research. "Engineering & Applied Sciences Undergraduate Degrees by Program of Study, 2015-2016." Columbia University, 16 Nov. 2016. Web. 04 Dec. 2016.

[†]It should be noted that for the analysis presented in this paragraph, the sample sizes were relatively small. Future studies may elucidate whether these trends hold more broadly.