
Report on Program Learning Outcomes

Computer Science Program



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1. Introduction

During the establishment of Student learning Outcomes (SOs) for Computer Science program, relevant academic and professional advice was considered. More Specifically, the process started by considering the latest recommendations of world renowned societies such as IEEE/CS, CSAB, ACM in the computer science area. In addition the requirements of national and international accreditation agencies (NCAAA and ABET) as well as the Saudi National Qualification Framework (NQF) were extensively considered in the formulation of the SOs. Note that SOs are broad statements that describe what students will be able to do and know by the end of the program (time of graduation). In the first semester of academic year (1432/1433) 2011/2012, the Development and Quality Unit (DQU) at the college of Computer Science and Information Systems (CSIS) at Najran University met with all faculty members and discussed the formulation of intended student learning outcomes for the Computer Science program (CS). The department faculty members including male and female gave their opinions through several meetings, discussions and surveys about the proposed SOs. Further, DQU met with students' representatives from the male and female campuses (Male and Female Student Committee) and make the proposed SOs available to them but there have been no major comments on the proposed SOs. In the Second Semester (1432/1433) 2011/2012, the Program Advisory Committee (PAC) including representatives from the public and private industries and professors from other universities reviewed the proposed SOs and gave their opinions through a filled survey. Based on the comments received from the program's stakeholders and after careful review of the requirements of accreditation agencies (NCAAA and ABET) and NQF as well as the recommendations of societies (IEEE/CS, CSAB, ACM), the program, in the academic year 1433/1434 (2012/2013), decided to:

- Adopt the ABET a-k CS Student Outcomes (SOs) for the Computer Science program at Najran University (NU).

- Modify the CS curriculum by adding extra courses related to mathematics and sciences to ensure consistency with NCAAA, ABET and NQF.
- Approve that the university Preparatory Year (PY) is part of the CS program because its student learning outcomes are very consistent with the SOs of the CS program. The total credit hours of the CS program including PY ($107 + 27 \text{ (PY)} = 134$ credit hours) meets the NQF minimum requirement of 120 credit hours for a bachelor degree.

The NCAAA and NQF identify SLOs (Student Learning Outcomes) in five learning domains: Knowledge, Cognitive Skills, Interpersonal Skills and Responsibility, Communication Information Technology and Numerical, and Psychomotor Skills. It is required that the SOs of a program must be consistent with NQF and covering all of the domains of learning except psychomotor level. However, the ABET a-k CS SOs adopted by our program has no outcomes that belong explicitly to the NCAAA knowledge skills level. Yet, if two learning outcomes have the same contexts with different levels of learning, then we can only consider one learning outcome with the higher level of learning. Assume we have the following outcomes:

- Describe a computer-based system or program to meet desired needs;
- Design a computer-based system or program to meet desired needs;

Using the above outcomes, it is acceptable to consider the second outcome because if students are able to design, it is obvious that they are able to describe. Table 1 illustrates the SOs of the CS program written in NCAAA learning domains. Our set of SOs is consistent with the NQF learning domains even though we don't have explicit SOs at the knowledge skills level. The following points justify our choices of having no explicit outcomes at the knowledge level:

- Outcomes at the knowledge level have the same contexts as those at the cognitive level. Therefore, if students achieve SOs at the cognitive level, it is obvious that they achieve it at the knowledge level.

- A set of outcomes at the knowledge level is delivered throughout the program (Courses and other strategies) to support the achievements of outcomes at the cognitive level.

ABET a-k CS outcomes are world-wide and are adopted by the best universities (KFUPM and KSU) in Saudi Arabia.

Table 1: SOs of the Computer Science Program

	NQF Learning Domains and Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
2.0	Cognitive Skills		
2.1	An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline;	<ul style="list-style-type: none"> • Lecture: Teacher gives concepts theoretically and by applying those to a real-world case study to be discussed using different examples on different situations. • Discussions: the teacher gives an idea to students and asks them to give their viewpoints, as well as, their reasoning regarding it. • Cooperative Learning: Teacher divides students into groups who are given problem-based assignments and homework to be submitted on a specified deadline. • Student-centred learning should be designed to facilitate the learner in doing, thinking, manipulating, constructing, testing, analysing and reflecting. • Organizing the flow of thoughts. • Increasing teaching efficiency by use of software. • Participating in tutorial classes and 	<p><u>Direct Methods:</u></p> <ol style="list-style-type: none"> 1. Course Learning Outcomes assessment (Each Semester) 2. Performance Indicators with a set of rubrics (once every assessment cycle) <p><u>Indirect Methods:</u></p> <ol style="list-style-type: none"> 1. Exit Survey (Each Semester) 2. Current Student Survey (Each Semester) 3. PAC Meeting and Discussions (Once a Year)
2.2	An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;		
2.3	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs;		

2.4	An ability to use current techniques, skills, and tools necessary for computing practice;	<ul style="list-style-type: none"> open lab. Use more real life examples in the lecture relating to the surroundings of the students to draw attention that certainly helps them to concentrate more on the specific topic. (b-i-3) During laboratory hours all concepts of theory are discussed through applying them to a case study. During this discussions between the teacher and students regarding open-ended problems are taking place. 	4. Alumni Survey 5. Employer Survey
2.5	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices;	<ul style="list-style-type: none"> Website visits. Give an assignment that includes critical problem which can be answered by internet search, reading the provided outcome and to analyse it. Pick one student who fully understood a specific topic and let him describe in front of the class in his own manner. Recall the topics of last lecture and the critical issues based on different topics, which certainly helps students to recall memory frequently and store that topic in their memory for long term. 	
2.6	An ability to apply design and development principles in the construction of software systems of varying complexity.	<ul style="list-style-type: none"> Before start a new topic or at the end of each topic, students are given couple of minutes to imagine the real life scenarios relating to that topic including implementation, advantages, deficiencies etc. to improve their logical thinking. 	
3.0	Interpersonal Skills & Responsibility		
3.1	An ability to function effectively on teams to accomplish a common goal;	<ul style="list-style-type: none"> Lectures in which students are made aware of the significance of time management. c-ii-2. Creation of interactive teaching and learning environment. 	Direct Methods: 1. Course Learning Outcomes assessment (Each Semester)
3.2	An understanding		

	of professional, ethical, legal, security and social issues and responsibilities;	<ul style="list-style-type: none"> Discussions with students on ethical behaviour in conducting research. Quiz competition among groups. Individual counselling on assignments, research project and subject matter difficulties. 	2. Performance Indicators with a set of rubrics (once every assessment cycle)
3.3	An ability to analyse the local and global impact of computing on individuals, organizations, and society;	<ul style="list-style-type: none"> Group assignments and discussions where much of the most effective learning comes from the student explaining, discussing and defending her own ideas with his peers. 	<p>Indirect Methods:</p> <ol style="list-style-type: none"> Exit Survey (Each Semester) Current Student Survey (Each Semester) PAC Meeting and Discussions (Once a Year) Alumni Survey Employer Survey
3.4	An ability to recognize the need for and to engage in continuing professional development;	<ul style="list-style-type: none"> Developing the awareness and confidence among students about their interpersonal know how. Students' counselling and advising. Making students alert about class attendance, timing, cleanliness and manner inside the class. Encouraging a self-critical evaluation of student existing knowledge and behaviour pattern in solving problems in classroom. During laboratory hours all concepts of theory are discussed through applying them to a case study. During this discussions between the teacher and students regarding open-ended problems are taking place. This strengthens both decisions making skills when choosing among a couple of alternatives and communication skills among them because the teacher is expected that all students participate in such discussions. 	
4.0	Communication, Information Technology, Numerical		

4.1	An ability to communicate effectively with a range of audiences	<ul style="list-style-type: none"> • Assigning projects/assignments where students must search the relevant material/resource from internet to finish the task. • Deliver lectures in a steady pace with a loud voice and clear-perfect pronunciation. • Ask about different ideas on a specific topic in the lecture. • Class participation by oral questioning and answering. • Encourage students to consult the specialist in the computer lab or IT department for help on web-based material. • Assign research papers that must include analysis of material taken from acceptable web sites. • Demand the use of power point when giving presentations in specific topics of lectures, assignments, and projects . • Solving lots of problems in programming and database systems, its performance, and design. • Require that written homework be typed in proper format. • Numerical skills assessed during orientation. Special tutorials provided for those in need. • Assignments include numerical analysis whenever relevant to topic concerned. • Students will be divided into groups and given programming-based assignments which will help them to work collaboratively, decide independently, and learn more skills to communicate with people. • During laboratory hours all theoretical concepts are discussed through 	<p><u>Direct Methods:</u></p> <ol style="list-style-type: none"> 1. Course Learning Outcomes assessment (Each Semester) 2. Performance Indicators with a set of rubrics (once every assessment cycle) <p><u>Indirect Methods:</u></p> <ol style="list-style-type: none"> 1. Exit Survey (Each Semester) 2. Current Student Survey (Each Semester) 3. PAC Meeting and Discussions (Once a Year) 4. Alumni Survey 5. Employer Survey
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		<p>applying them to a case study. During this discussions between the teacher and students regarding open-ended problems are taking place. This strengthens both decisions making skills when choosing among a couple of alternatives and communication skills among them because the teacher is expected to all students participate in such discussions.</p>	
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Enabled Student Characteristics

As indicated above, the department has adopted the ABET CAC's (a-k) student outcomes. Table 2 Table 3, and Table 4 show the relationships of CS major courses, non-major courses, and Preparatory Year (PY) courses to SOs respectively. More specifically, each course is mapped to one or more SOs. It is clear through these tables that all characteristics of SOs are covered with the courses especially the CS program specific SOs (SO (j) and SO (k)).

Table 2: Relationship of the Computer Science Courses in the Curriculum to the Student Outcomes

Required CS Courses	Student Learning Outcomes (SOs)										
	2.1 An ability to apply knowledge of computing and mathematics appropriate to the discipline;	2.2 An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	2.3 An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	3.1 An ability to function effectively on teams to accomplish a common goal.	3.2 An understanding of professional, ethical, legal, security and social issues and responsibilities.	4.1 An ability to communicate effectively with a range of audiences;	3.3 An ability to analyze the local and global impact of computing on individuals, organizations, and society;	3.4 An ability to recognize the need for and to engage in continuing professional development.	2.4 An ability to use current techniques, skills, and tools necessary for computing practice.	2.5 An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices [CS].	2.6 An ability to apply design and development principles in the construction of software systems of varying complexity [CS].
111CSS-4 Programming Language 1	√	√	√						√	√	√
113CSS-4 Object Oriented Programming	√	√	√				√	√	√	√	√
212CSS-3 Data Structures	√	√	√						√	√	√
222CSS-4 Computer Organization and Architecture	√					√			√	√	√
227CSS-3 Operating Systems	√	√	√						√	√	√
235CSS-3 Theory of Computation	√	√	√			√		√	√	√	√
281CSS-3 Computer Graphics	√	√	√						√	√	
328CSS-3 Human and Computer Interaction	√	√	√						√	√	√
329CSS-3 Data Communication and Computer Networks	√	√	√						√	√	
330CSS-3	√	√	√					√	√		√

Programming Paradigms											
342CSS-3 Software Engineering	√	√	√	√	√	√	√	√	√	√	√
361CSS-3 Artificial Intelligence	√	√	√					√	√	√	√
380CSS-3 Fundamental of Database Systems	√	√	√	√		√			√	√	√
429CSS-3 Computer Security	√	√	√	√					√	√	√
440CSS-3 Social, Ethical, and Professional Issues		√			√		√	√			
456CSS-3 Parallel and Distributed Systems	√	√	√						√	√	
457CSS-3 Internet Technologies	√	√	√		√				√	√	√
474CSS-3 Design and Analysis of Algorithms	√	√	√							√	
491CSS-4 Graduation Project 1	√	√	√	√	√	√		√	√	√	√
492CSS-4 Graduation Project 2	√	√	√	√	√	√		√	√	√	√

Table 3: Relation of non major courses in the curriculum to the Student Outcomes

Non-CS Courses	Student Learning Outcomes a-k										
	2.1 An ability to apply knowledge of computing and mathematics appropriate to the discipline;	2.2 An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution.	2.3 An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	3.1 An ability to function effectively on teams to accomplish a common goal.	3.2 An understanding of professional, ethical, legal, security and social issues and responsibilities.	4.1 An ability to communicate effectively with a range of audiences;	3.3 An ability to analyze the local and global impact of computing on individuals, organizations, and society;	3.4 An ability to recognize the need for and to engage in continuing professional development.	2.4 An ability to use current techniques, skills, and tools necessary for computing practice.	2.5 An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices[CS].	2.6 An ability to apply design and development principles in the construction of software systems of varying complexity [CS].
	101BIOL-4 General Biology	√	√						√		
	104PHIS-4 Fundamental of Physics	√	√						√	√	
	105PHIS-4 Advanced Physics	√	√						√	√	
	106MATH-3 Introduction to Integration	√								√	
	111ISL-2 Introduction to Islamic Culture				√	√					
	112ISL-2 Islamic Culture 2				√	√					
	113ISL-2 Islamic Culture 3				√	√				√	
	114ISL-2 Islamic Culture 4				√	√					
	152MATH-3 Discrete Mathematics	√								√	
	201ARAB-2 Arabic Skills				√	√					
202ARAB-2 Arabic Writing				√	√						

203MATH-3 Advanced Calculus	√	√							√	√	
324STAT-3 Probabilities and Engineering Statistics	√										
341CIS-3 Operational Research	√	√	√						√	√	√
342MATH-3 Linear Algebra	√									√	

Table 4: Relation of Preparatory Year courses in the curriculum to the Student Outcomes

PY Courses	Student Learning Outcomes a-k										
	2.1 An ability to apply knowledge of computing and mathematics appropriate to the discipline;	2.2 An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution.	2.3 An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	3.1 An ability to function effectively on teams to accomplish a common goal.	3.2 An understanding of professional, ethical, legal, security and social issues and responsibilities.	4.1 An ability to communicate effectively with a range of audiences;	3.3 An ability to analyze the local and global impact of computing on individuals, organizations, and society;	3.4 An ability to recognize the need for and to engage in continuing professional development.	2.4 An ability to use current techniques, skills, and tools necessary for computing practice.	2.5 An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices[CS].	2.6 An ability to apply design and development principles in the construction of software systems of varying complexity [CS].
140TEC-3 Computer Skills	√	√	√			√			√		√
140MATH-2 Introduction of Mathematics	√										
140SKL-2 Learning, Thinking and Research Skills				√	√	√					
140ENG-2 English Language: Reading Skills		√		√	√	√					
141ENG-2 English Language: Writing Skills		√		√		√		√	√		

142ENG-2 English Language: Listening and Speaking Skills						√					
143ENG-2 English Language: Grammars	√					√					
150MAN-1 Occupational Ethics				√	√	√					
150MATH-4 Algebraic Sciences	√										
150SKL-2 Communication Skills											
150ENG-2 English Language: Speaking	√			√	√	√	√		√		√
150ENG-3 Report Writing				√	√	√			√		√

Currently, the student learning outcomes (PLOs) or student outcomes (SOs) are assessed by using both direct and indirect assessment methods. In this report we present PLOs/SOs assessment data from the two direct assessment methods including:

1. Assessment of student learning outcomes using course learning outcomes (CLOs)
2. Assessment of student learning outcomes using performance indicators (PIs), Embedded Questions and Rubrics

1. Assessment of student learning outcomes using course learning outcomes (CLOs):

The idea behind this method is that all courses are mapped to the appropriate student outcomes by relating CLOs of all courses to SOs. Mapping courses to SOs ensures that all SOs are addressed by several courses at different levels in the program. In addition, this will help us to know if student outcomes have not been met at a particular course. The assessment of SOs using CLOs assessment each semester supports us to maintain a semester-based continuous improvement by using the achievements of CLOs. The expected performance is 65% for each SO. Note that courses that are related to a specific SO have equal contribution.

2. Assessment of student learning outcomes using performance indicators (PIs), Embedded Questions and Rubrics:

This is our overall assessment method to evaluate the attainment of SOs. A set of Performance Indicators were developed for each one of the SOs. PIs are then aligned to the curriculum to facilitate the collection of data. Data are then evaluated by using a set of rubrics. In this method, we collect data and evaluate each SO once in a complete assessment cycle (3-4 years).

The first cycle of PLOs or SOs assessment through PIs, embedded questions and rubrics started in 2012/2013 and finished in 2015/2016. Hence, the College of CSIS has planned a new cycle for the academic years 2017-2021 to assess the PLOs/ SOs and the new assessment plan is described below:

- Assessment plan is shown in Figure 1.

✓ **Assessment Types**

- We are using direct assessment and it will be achieved through performance indicators (PIs) for all CS SOs and using course learning outcomes (CLO). He said that direct assessment will be used for the direct examination or observation of student knowledge, skills and/or behaviours. e.g. Exams, Presentation, etc.
- Indirect assessment will be done through indirect methods, e.g. exit surveys, current student survey and meeting and survey with program advisory committee.

✓ **Assessment Methods**

The formative and summative assessment methods which will be used in updated assessment plan for year 2017 – 2021 are:

- **Formative Assessment.**
 - ▶ Formative assessments are on-going assessments, reviews, and observations in a classroom and or within an academic year or pre-determined time.
 - ▶ We should use formative assessment to improve instructional methods and student feedback throughout the teaching and learning process.
 - ▶ The goal of formative assessment is to *monitor student learning* to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning.

- ▶ Example of formative assessment is quizzes, assignments, midterms, etc. It will be used in level 3 to 6.
- **Summative Assessment.**
 - ▶ Summative assessments are typically used to evaluate the effectiveness of instructional programs and services at the end of an academic year or at a pre-determined time.
 - ▶ The goal of summative assessments is to make a judgment of student competency after an instructional phase is complete.
 - ▶ The goal of summative assessment is to evaluate student learning at the end of an instructional unit by comparing it against some standard or benchmark.
 - ▶ Example of summative assessment is final exams, nationwide Tests and it will be done from levels 7 and 8.

Proposed CSIS Assessment Planning 2017-2021(Conceptual Model)

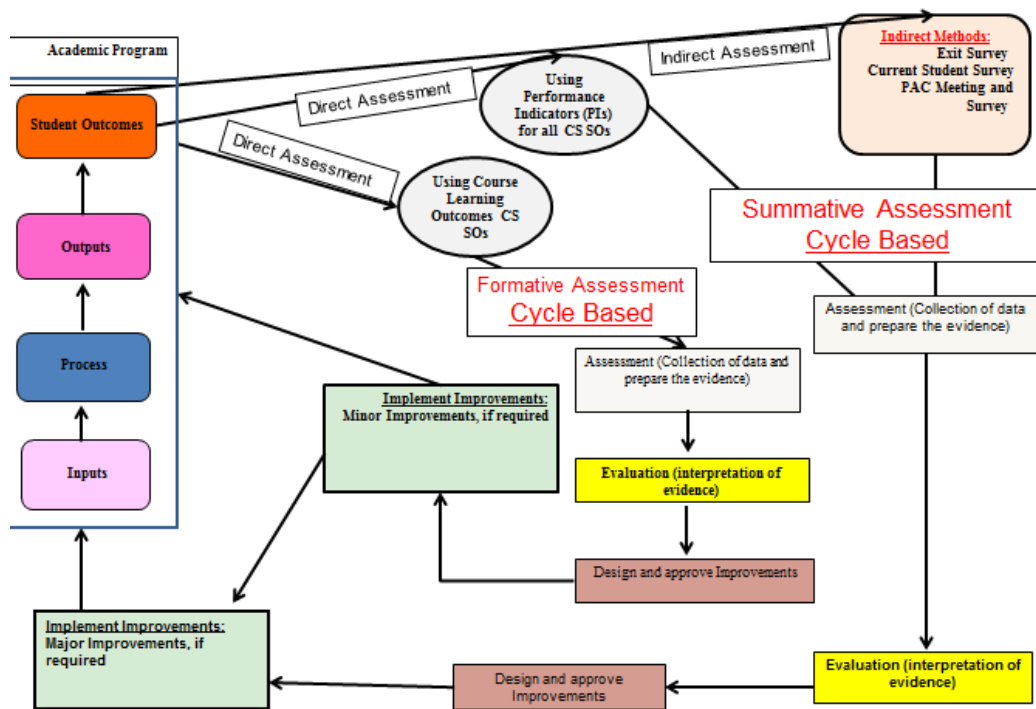


Figure 1: CSIS Assessment Plan for 2017 – 2021

- It has been presented the PLOs/SOs assessment plan time line for CS program. Figure 2 shows the PLOs/SOs assessment plan time line for computer science program.

Program: Computer Science (CS):..... SOs Assessment Plan Time Line

Student Outcomes (SOs)	CLOs Achievements						PIs and Rubrics						Exit Survey						Current Student Survey						PAC Survey								
	F 16/17	S 16/17	F 17/18	S 17/18	F 18/19	S 18/19	F 19/20	S 19/20	F 16/17	S 16/17	F 17/18	S 17/18	F 18/19	S 18/19	F 19/20	S 19/20	F 16/17	S 16/17	F 17/18	S 17/18	F 18/19	S 18/19	F 19/20	S 19/20	F 16/17	S 16/17	F 17/18	S 17/18	F 18/19	S 18/19	F 19/20	S 19/20	
a) An ability to apply knowledge of computing and mathematics appropriate to the discipline	C	E	I										C	E	I					C	E	I											
b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution			C	E	I									C	E	I					C	E	I										
c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs				C	E	I								C	E	I						C	E	I									
d) An ability to function effectively on teams to accomplish a common goal			C	E	I									C	E	I						C	E	I									
e) An understanding of professional, ethical, legal, security and social issues and responsibilities				C	E	I								C	E	I						C	E	I									
f) An ability to communicate effectively with a range of audiences	C	E	I											C	E	I					C	E	I										
g) An ability to analyze the local and global impact of computing on individuals, organizations, and society				C	E	I								C	E	I						C	E	I									
h) An ability to recognize the need for and to engage in continuing professional development				C	E	I								C	E	I						C	E	I									
i) An ability to use current techniques, skills, and tools necessary for computing practice	C	E	I											C	E	I					C	E	I										
j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices			C	E	I									C	E	I						C	E	I									
k) An ability to apply design and development principles in the construction of software systems of varying complexity				C	E	I								C	E	I						C	E	I									

Figure 2: SO Assessment plan time line for Computer Science Program

It has been discussed that DQU mode five groups which will be responsible for assessment of SOs for CS program. These five groups are shown in Table 5.

Table 5: SO Assessment groups for Computer Science Program

Group No.	Coordinators	Members	Student Outcomes
Group 1	Dr. Fekri	Ms. Saira Ms. Eman Dr. Khairi Mr. Basit Mr. Omar Mr. Mazen Gazzan Mr. Khalid Makdi	a i
Group 2	Dr. Shargabi	Ms. Nazeema Ms. Enam Dr. Muniba Mr. Selim Mr. Akram Mr. Adlan Mr. Abdullah Al Qahtani	b f
Group 3	Dr. Asadullah	Ms. Rania Ms. Dalal Dr. Addin Mr. Shah Masud Mr. Naif Mr. Saltan Al Azmei	d j
Group 4	Dr. Ghassan	Ms. Gulshan Ms. Suad Dr. Khairan Mr. Golam faruque Mr. Yahya Mr. Bakri Mr. Mohammad Al Shahrani	c e

Group °	Dr. Abdurrahman	Ms. Nyla Ms. Sumaiya Dr. Abwar Mr. Kafil Mr. Haji Mr. Moath Mr. Hamad Ali Mr. Ahmad Al Musabi	g h k
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3. Data

Assessment of student learning outcomes using course learning outcomes

The following tables (Table 6, 7, 8, 9, 10, 11) illustrates the attainment of Student Learning Outcomes (SOs) using the assessment of Course Learning Outcomes of First and Second semesters in the academic year 2016/2017 for the CS program of both Male and Female sections. The idea behind this method is that all courses are mapped to the appropriate student outcomes by relating CLOs of all courses to SOs. Mapping courses to SOs ensures that all SOs are addressed by several courses at different levels in the program. In addition, this will help us to know if student outcomes have not been met at a particular course. The assessment of SOs using CLOs assessment each semester supports us to maintain a semester-based continuous improvement by using the achievements of CLOs. The expected performance is 65% for each SO. Note that courses that are related to a specific SO have equal contribution. Figure 3 illustrates graphical representation of SOs using CLOs in the academic year 2016/2017.

Table 6: Achievements of SOs using CLOs Achievements for CS courses First Semester
2016/2017 (Boys Campus)

Course name	Code	Student Outcomes (SOs) (in %)										
		2.1 (a)	2.2 (b)	2.3 (c)	3.1 (d)	3.2 (e)	4.1 (f)	3.3 (g)	3.4 (h)	2.4 (i)	2.5 (j)	2.6 (k)
Programming Language 1	111CSS-4	50	20	40						30	40	35
Object Oriented Programming	113CSS-4	25	25	37.5				25	25	25	25	25
Data Structures	212CSS-3	58.33	50	66.67						66.67	33.33	66.67
Computer Organization and Assembly Language	222CSS-3	Not applicable as the number of students is less than 5										
Unix System Environment	226CSS-2	Not Applicable										
Operating Systems	227CSS-3	Not Available										
Theory of Computation	235CSS-3	73	73	60			100		100	67	60	80
Computer Graphics	281CSS-3	75	87.5	25						43.75	83.33	
Human Computer Interaction	328CSS-3	Not Available										
Data Communication and Computer Networks	329CSS-3	Not applicable as the number of students is less than 5.										
Programming Paradigms	330CSS-3	Not applicable as the number of students is less than 5.										
Computer Architecture for Computer Science	333CSS-3	Not Applicable										
GUI Programming	340CSS-3	Not Applicable										
Software Engineering	342CSS-3	33.33	61.11	33.33		66.6			66.6	41.6	66.6	44.44
Compiler Design and Construction	345CSS-3	100	0						0	100	100	
Artificial Intelligence	361CSS-3	Not Available										
Fundamentals of Database Systems	380CSS-3	Not applicable as the number of students is less than 5										
Computer Security	429CSS-3	Not applicable as the number of students is less than 5										
Social, Ethical and Professional Issues	440CSS-3	Not Available										
Parallel and Distributed Systems	456CSS-3	35.8	42.3							61.5	40.3	
Internet Technologies	457CSS-3	Not Available										

Design and Analysis of Algorithms	474CSS-3	Not Available										
Average		56.30	44.86	43.75	0	66.6	100	25	47.9	54.44	56.07	50.222

Table 7: Achievements of SOs using CLOs Achievements for CS courses First Semester
2016/2017 (Girls Campus)

Course name	Code	Student Learning Outcomes (SOs) (in %)										
		2.1 (a)	2.2 (b)	2.3 (c)	3.1 (d)	3.2 (e)	4.1 (f)	3.3 (g)	3.4 (h)	2.4 (i)	2.5 (j)	2.6 (k)
Programming Language 1	111CSS-4	83.34		85.19	-	-	-	-	-	85.19	88.8	83.34
Object Oriented Programming	113CSS-4	Not Available										
Data Structures	212CSS-3	91.6	83.33	100						83.33	83.3	100
Computer Organization and Architecture	222CSS-4	84.37								75	75	
Operating Systems	227CSS-3	66.66	100	85.71						92.85	71.4	
Theory of Computation	235CSS-3	Not Available										
Computer Graphics	281CSS-3	64.71	64.71	64.71						56.86	56.8	
Human Computer Interaction	328CSS-3	Not Available										
Data Communication and Computer Networks	329CSS-3	Not Available										
Programming Paradigms	330CSS-3	66.6	75	42						70.8	42	
Software Engineering	342CSS-3	Not Available										
Compiler Design and Construction	345CSS-3	88.33	88.88						100	84.77	93.3	
Artificial Intelligence	361CSS-3	85.71	78.57	71.43						75	76.7	78.57
Fundamentals of Database Systems	380CSS-3	Not Available										
Modern Topics in Computer Science	410CSS-3	Not Available										
Computer Security	429CSS-3	87.5	75							81.2	81.2	

Social, Ethical and Professional Issues	440CSS-3	Not applicable as the number of students are less than 5										
Parallel and Distributed Systems	456CSS-3	88.89	92.59	100							88.8	
Internet Technologies	457CSS-3	Not applicable as the number of students are less than 5										
Design and Analysis of Algorithms	474CSS-3	100	83.37	100							88.8	
Average		82.5	82.38	81.13	0	0	0	0	100	78.33	76.91	87.30

Table 8: Achievements of SOs using CLOs Achievements

No	NQF Learning Domains and Learning Outcomes			
1.0	Knowledge			
2.0	Cognitive Skills	First Semester 2016/2017		2016/2017 Overall Evaluation in %
		Male	Female	
2.1	An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline;	56.3	82.5	69.4
2.2	An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;	44.86	82.38	63.62
2.3	An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs;	43.75	81.13	62.44
2.4	An ability to use current techniques, skills, and tools necessary for computing practice;	54.44	78.33	66.385
2.5	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the	56.07	76.91	66.49

	modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices;			
2.6	An ability to apply design and development principles in the construction of software systems of varying complexity.	50.222	87.3	68.761
3.0	Interpersonal Skills & Responsibility	First Semester 2016/2017		Overall Evaluation
		Male	Female	
3.1	An ability to function effectively on teams to accomplish a common goal;	0	0	0
3.2	An understanding of professional, ethical, legal, security and social issues and responsibilities;	66.6	0	33.3
3.3	An ability to analyse the local and global impact of computing on individuals, organizations, and society;	25	0	22.5
3.4	An ability to recognize the need for and to engage in continuing professional development;	47.9	100	73.95
4.0	Communication, Information Technology, Numerical	First Semester 2016/2017		Overall Evaluation
		Male	Female	
4.1	An ability to communicate effectively with a range of audiences	100	0	50

Table 9: Achievements of SOs using CLOs Achievements for CS courses Second Semester
2016/2017 (Boys Campus)

Course name	Code	Student Outcomes (SOs) (in %)										
		2.1 (a)	2.2 (b)	2.3 (c)	3.1 (d)	3.2 (e)	4.1 (f)	3.3 (g)	3.4 (h)	2.4 (i)	2.5 (j)	2.6 (k)
Programming Language 1	111CSS-4											
Object Oriented Programming	113CSS-4	25	25	37.5				25	25	25	25	25
Data Structures	212CSS-3	87.50	50	50						100	50	75
Computer Organization and Assembly Language	222CSS-3	Not applicable as the number of students is less than 5										
Unix System Environment	226CSS-2	Not Applicable										
Operating Systems	227CSS-3	80.95	28.57	42.86						50.00	85.71	
Theory of Computation	235CSS-3	100	100	100			100		100	100	100	100
Computer Graphics	281CSS-3	75	60	40						55	73.33	
Human Computer Interaction	328CSS-3	Not Available										
Data Communication and Computer Networks	329CSS-3	Not Available										
Programming Paradigms	330CSS-3	Not Applicable										
Computer Architecture for Computer Science	333CSS-3	Not Applicable										
GUI Programming	340CSS-3	Not Applicable										
Software Engineering	342CSS-3	Not Available whether number of students was 5										
Compiler Design and Construction	345CSS-3	55	60						80	40	45	
Artificial Intelligence	361CSS-3	Not applicable as the number of students is less than 5										
Fundamentals of Database Systems	380CSS-3	Not Applicable										
Computer Security	429CSS-3	Not Applicable										
Social, Ethical and Professional Issues	440CSS-3	Not Available										
Parallel and Distributed Systems	456CSS-3	33.33	60							100	65	
Internet Technologies	457CSS-3	Not Available										

Design and Analysis of Algorithms	474CSS-3	Not Available										
Average		54.44	60	40					80	65	61.11	60.09

Table 10: Achievements of SOs using CLOs Achievements for CS courses Second Semester
2016/2017 (Girls Campus)

Course name	Code	Student Learning Outcomes (SOs) (in %)										
		2.1 (a)	2.2 (b)	2.3 (c)	3.1 (d)	3.2 (e)	4.1 (f)	3.3 (g)	3.4 (h)	2.4 (i)	2.5 (j)	2.6 (k)
Programming Language 1	111CSS-4					Not Available						
Object Oriented Programming	113CSS-4	Not Available										
Data Structures	212CSS-3	85.71	89.28	71.43						92.86	92.86	75
Computer Organization and Architecture	222CSS-4	88.63								84.85	90.91	
Operating Systems	227CSS-3	83.33	87.5	75						87.5	100	
Theory of Computation	235CSS-3	Not Available										
Computer Graphics	281CSS-3	87.5	100	50						55.56	70.83	
Human Computer Interaction	328CSS-3	Not Available										
Data Communication and Computer Networks	329CSS-3	Not Available										
Programming Paradigms	330CSS-3	46.15	80.77	69.23						71.21	69.23	
Software Engineering	342CSS-3	83.33	66.67	77.78	66.67	66.67	66.67		66.67	66.67	83.33	66.67
Compiler Design and Construction	345CSS-3	80.77	71.79						92.31	74.36	92.31	
Artificial Intelligence	361CSS-3	75	81.25	75						75	75	70.83
Fundamentals of Database Systems	380CSS-3	Not applicable as the number of students are less than 5										

Modern Topics in Computer Science	410CSS-3	Not Available										
Computer Security	429CSS-3	100	100							75	75	
Social, Ethical and Professional Issues	440CSS-3		100			75		100	50			
Parallel and Distributed Systems	456CSS-3	85.7	76.19	71.43							80.95	
Internet Technologies	457CSS-3	77.78	88.89	88.33						88.89	88.89	86.11
Design and Analysis of Algorithms	474CSS-3	100	62.5	100							66.66	
Average		85.93	83.47	76.79	66.67	70.83	66.67	100	69.66	74.71	81.44	74.53

Table 11: Achievements of SOs using CLOs Achievements

CS PLOs/SOs	2.1 (a)	2.2 (b)	2.3 (c)	3.1 (d)	3.2 (e)	4.1 (f)	3.3 (g)	3.4 (h)	2.4 (i)	2.5 (j)	2.6 (k)
CS Male Overall	65.25	54.79	54.07			100	25	68.33	67.14	63.43	63.54
CS Female Overall	82.82	83.47	75.45	66.67	70.83	66.67	100	69.66	77.18	82.16	74.65
CS Overall Sos Assessment	74.035	69.13	64.76	66.67	70.83	83.335	62.5	68.995	72.16	72.795	69.095

Assessment of student learning outcomes using performance indicators (PIs), Embedded Questions and Rubrics:

The assessment of the DQU at college of computer science and information systems for the cycle (2017-21), had selected SO(a) and SO(i) for assessment in the first semester of 2016-17 i.e Semester 371.

Student Outcome (a,i):

- a) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution
- i) An ability to use current techniques, skills, and tools necessary for computing practice

Semester/Year Data collected: 371, **First Semester, 2016/2017**

Assessment Coordinator (Collection Agent): **Dr. Fikri Abdul Wedood**

Table 12: Assessment Process

SO	SO Description	Sources of Assessment	Assessment Method(s)	Target of Achievement	Evaluation of Results
a and i	<p>An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution</p> <p>An ability to use current techniques, skills, and tools necessary for computing practice</p>	<p>361CSS-3</p> <p>222CSS-3</p> <p>227CSS-3</p> <p>329CSS-3</p> <p>113CSS-3</p>	Embedded assessment	65% of the students at the accomplished or above levels	SO Assessment Group

Evaluation Results

1. The instructors of the corresponding courses were asked to make question based on CLO's which had has a mapping to SO(a) and SO(i)
2. The instructor submitted to the SO assessment group, the scanned answer scripts of the students along with students grades achieved in that particular question.
3. The SO Assessment group aggregated ,evaluated and analyzed the results

4. Based on the results action are proposed, to be taken in the assessment and evaluation stages!!

Table 13: Achievement for PLOs/ SOs (a,i) from all the selected CS Courses in both Male and Female Sections (presented in %)

CS Course	SO (a)	SO (i)
113CSS-3	44	40
329CSS-3	100	75
227CSS-3	40	86
222CSS-3	69	56
361CSS-3	50	72
Overall Achievement	60.09	74.53

4. Analysis

The Figure 3 shows the overall program learning outcomes (PLOs) / SOs achievement using CLOs in CS program for the first semester and second semester of the academic year 2016/2017. The assessment of SOs using CLOs assessment each semester supports us to maintain a semester-based continuous improvement by using the achievements of CLOs. The expected performance is 65% for each SO. Note that courses that are related to a specific SO have equal contribution. Figure 3 illustrates graphical representation of SOs using CLOs in the academic year 2016/2017.

CS Overall PLOs/SOs Assessment Report Using CLOs

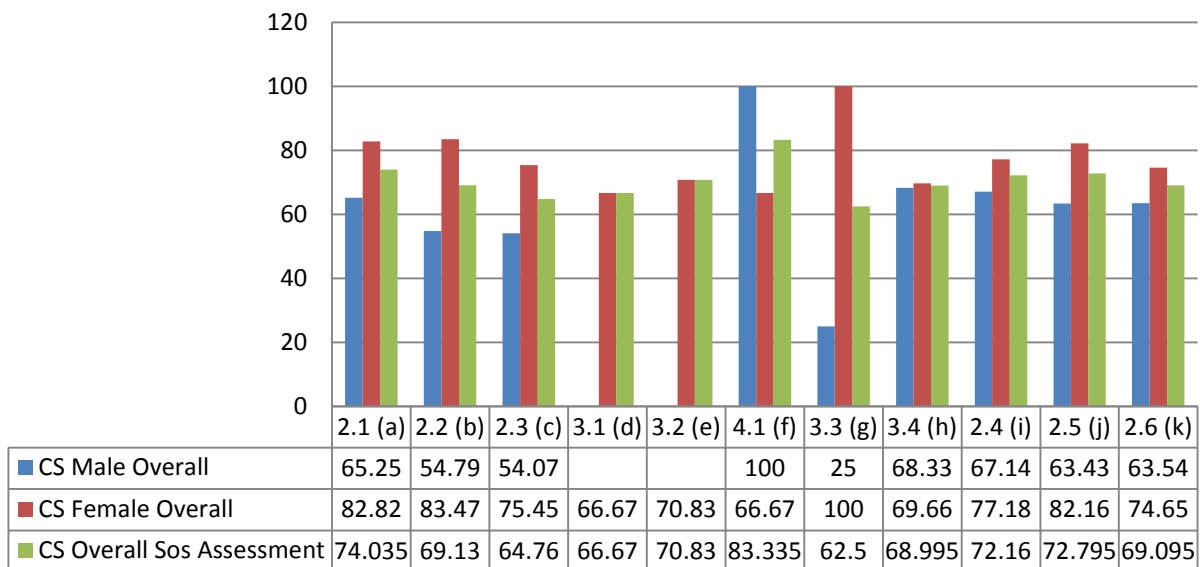


Figure 3: Student outcomes Achievements using

CLOs achievements for the first semester and second semester of the academic year 2016/2017

The Figure 4 shows the overall program learning outcomes (PLOs) / SOs achievement using PIs/ embedded questions in CS program for the first semester and second semester of the academic year 2016/2017.

The assessment of SOs using PIs/ embedded questions assessment each semester supports us to maintain a semester-based continuous improvement by using the achievements of PIs/ embedded questions. The expected performance is 65% for each SO. Note that courses that are related to a specific SO have equal contribution. Figure 4 illustrates graphical representation of SOs using PIs/ embedded questions in the first semester of academic year 2016/2017.

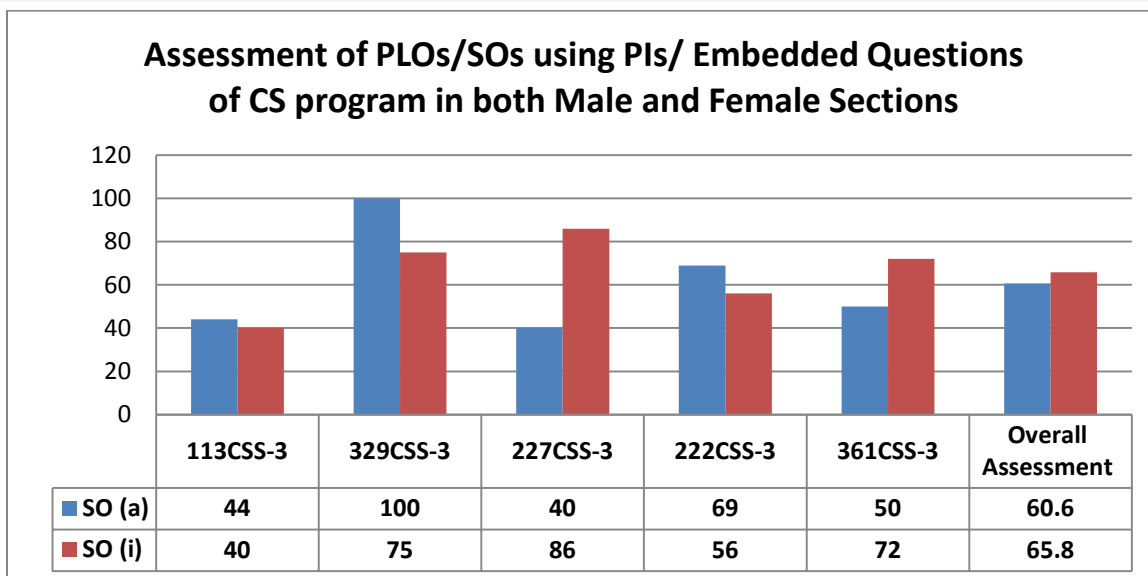


Figure 4: Illustrates graphical representation of SOs using PIs/ embedded questions in the first semester of academic year 2016/2017.

5. Conclusion

This report will give the opportunity to the faculty members of the program to bolster their teaching and relevant activities to enhance the quality of their teaching and to achieve more student learning outcomes.

Annexes:

1. Annex 1: PLOs/SOs assessment data using CLOs
2. Annex 2: PLOs/SOs assessment data using PIs, Embedded questions, Rubrics