Fall 2018, Midterm Exam (60 min In class Exam) Oct. 26(Friday PM 1 at 32255)							**Sign**
Course	Discrete Math		**SKKU**	**Fall 2018**	Prof.	Sang-Gu LEE	
Class #	42	Major 전공		Student No. 학번			**Name**

※ **Notice/Reference** http://matrix.skku.ac.kr/2018-DM/Ch-5/
http://matrix.skku.ac.kr/2018-album/2018-S-DM-Midterm-Exam-Solution.pdf http://matrix.skku.ac.kr/2018-album/2018-Lectures-sglee.htm

1. **Fill out the above boxes before you start this Exam.** (학번, 이름 등을 기입하고 감독자 날인)
2. **Honor Code:** (시험 부정행위시 해당 교과목 성적이 "F" 처리됨은 물론 징계위원회에 회부될 수 있습니다.)
3. **You have 60 minutes to complete this exam. Leave at least one seat between each other.**
4. **Please write clearly and properly. If we cannot read your writing, it will not be graded.**

Total Score (100 pt)	
Offline Exam 80	Participation 20

(20 + 20 + 20 + 20 + 20 = 100)
A+: 10% A: 10% B+: 15% B: 15% C+: 15% C: 15% D, F: 20%

Part I. [2pt x 10= 20pt] True(T) or False(F). No explanations required.

[F] (1) A collection S of non-empty subsets of X is a partition of the set X if $X = S_1 \cup S_2 \cup \cdots \cup S_n$.(& $S_i \cap S_j = \varnothing$)

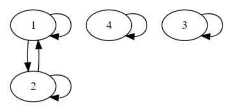
[F] (2) $\neg(p \vee q) \equiv \neg p \vee \neg q$. ($\neg(p \vee q) \equiv \neg p \wedge \neg q$ Answer)

[F] (3) Conditional proposition $p \to q$ and its contrapositive $\neg q \to p$ are logically equivalent. ($\neg q \to \neg p$)

[T] **(4) The Well-Ordering Property for nonnegative integers states that every nonempty set of nonnegative integers has a least element. This is equivalent to the Mathematical Induction and we use the Well-Ordering Property to prove something familiar from long division.**

[F] (5) [Ch.3 P.8] If α = $ccdc$ and β = c^3d^2, then $|\alpha\alpha\beta\alpha\beta| = 20$. ($\alpha$ and β are strings, 4+4+5+4+5 =22)

[T] **(6) The relation {(1,1),(1,2),(2,2),(4,4),(2,1),(3,3)} an equivalence relation on {1,2,3,4}.**



(Sol) 1. ∀x ∈X, (x,x) ∈R ⇒ (1,1),(2,2),(3,3),(4,4) ⇒ R is reflexive.
2. (x,y) ∈R ,(y,x) ∈R ⇒ (1,2),(2,1)/(1,1)/(2,2)/(3,3)/(4,4) ⇒ R is symmetric.
3. (1,2)(2,1) imply (1,1)/ (1,2)(2,2) imply (1,2)/ (1,1)(1,2) imply (1,2)/ (2,2)(2,1) imply (2,1) ⇒ R is transitive.
∴ R is **reflexive, symmetric, and transitive** and R **is an equivalence relation on** {1,2,3,4}. ■

[F] (7) Let U be a universal set. If we define $f(X) = \overline{X}$ where $X \in P(U)$, then f is a ~~binary~~ (unary) operator on $P(U)$. (If X is a set of propositions, $\wedge$, $\vee$, $\to$ and $\leftrightarrow$ are binary operator on X.)

[T] (8) Big-O notation has been used in mathematics for more than a century. In computer science it is widely used in the analysis of algorithms. The German mathematician Paul Bachmann first introduced big-O notation in 1892 in an important book on number theory. The use of big-O notation in computer science was popularized by Donald Knuth, who also introduced the big-omega and big-theta notations defined in this section. [or ... The domain of discourse is the Cartesian product of the set of students taking discrete math with itself (i.e. both x and y take on values in the set of students taking discrete math).]

[T] (9) **[Ch 5, Q.11]** Integers s and t satisfying $s \cdot 396 + t\,480 = \gcd(396, 480)$ are $s = 17$, $t = -14$.

(Sol) Prime factorization: $396 = 2^2 \times 3^2 \times 11^1$ and $480 = 2^5 \times 3^1 \times 5^1$

By the definition of gcd, $\gcd(m,n)$ is $p_1^{\min\{a_1,b_1\}} p_2^{\min\{a_2,b_2\}} \cdots p_k^{\min\{a_k,b_k\}}$, $\gcd(396,480)$ is $2^2 \times 3^1 = 12$

Substitute 17 and –14 for s and t respectively, $396 \times 17 + (-14 \times 480) = 6732 - 6720 = 12 = \gcd(396, 480)$

∴ The statement is true (T) ■

[T] (10) Let $K(x,y)$ be the propositional function "x knows y". The assertion "someone does not know anyone" in symbolic expression (someone does not know anyone) is $\exists x\, \forall y\, \neg K(x,y)$.

Part II. (20pt) State (Fill the boxes and/or state).

[5 Pts] (1) State more than 10 DM Definitions and concepts what you learned in Ch. 1, 2, 3, 4, 5.

$p \wedge q$ **is conjunction of** p **and** q**.** $p \wedge q$ **is read the proposition of "**p **and** q**."**
$p \vee q$ **is disjunction of** p **and** q**.** $p \vee q$ **is read the proposition of "**p **or** q**."**

10

A) A mod B 는 ~~[illegible]~~ $\frac{A}{B}$ 의 하고난 후 나머지 입니다.

B) $A \mid B$ 는 $\frac{B}{A}$ 를 말 합니다.

C) $\lceil A \rceil$ 는 celing 함수입니다. $n \le A < n+1$ 이면 $A = n+1$

D) $\lfloor A \rfloor$ 는 Floor 함수입니다. $n \le A < n+1$ 이면 $A = n$

E) 중국인 나머지정리는 $N = qA + r$ 이며 q는 몫, r은 나머지 입니다.

F) $\forall A$는 모든 A에 대하여 라는 뜻 입니다.

G) $\exists A$ 는 어떤 A 는 이란 뜻 입니다.

H) 2진수는 어떤수를 1, 0으로 만 표기하여, 몫이 0이 될때까지 ($\div 2$)를 진행하고 나머지 들을 나열한 방식입니다. ex) 110100

I) Best case time 과 Worst case time은 알고리즘을 연산할때 나올수 있는 걸리는시간의 경우의 수 중 각각 최상, 최악을 말합니다.

J) Big O, Big Ω notation과 Θ에 대해 배웠습니다.

k) one to one은 단사함수 onto는 전사함수 입니다.

- Chapter 1: Power Set, Cardinality, Intersection, Relative component, Proposition, De Morgan's law, Rules of Inference, Deductive Reasoning, Quantifiers and Domain of Discourse.
- Chapter 2: Axioms, Definitions, Proof by Contradiction, Proof by Contrapositive, Proof by Cases, Mathematical Induction and Well Ordering Property.
- Chapter 3: Functions, Pseudo Random Numbers, One to One Function (Injective), On to One Function (Bijective), String, Binary Relation, Symmetric/Anti-Symmetric relation, Equivalence Classes, Matrix of Relation, Relational Data Base.
- Chapter 4: Finiteness, Determinism, Insertion Sort, Big O notation, Theta Notation, Omega Notation and Recursive Function.
- Chapter 5: Prime Numbers, Composite numbers, Greatest Common Devisor, Prime Factorization, Least Common Multiple and The Euclidean Algorithm.

[5 Pts] (2) State 10 things that you can do after you studied the first 5 Chapters.

i) I can now find gcd using Eucleadian algorithm, ii) Can analyze algorithms iii) know if a function is one-one, on-to. iv) can now convert binary to decimal v) I now know how to prove statements by using proof by contradiction. vi) I can now write a program for prime checking vii) I know if a relation is reflexive, transitive, symmetrical. viii) I can now multiply 2 matrices. ix) I know about sets and relations. x) I can now know if a relation is a equivalence relation or not. xi) I can now code with better algorithms recursively

1.1. Since every chapter is a follow up for the chapter before it; it would be better to put a clear distinction between the academic and the mathematical things I have learnt from each part as following:

- Part 1:In chapter 1, I have filled and revised the knowledge I had back in school times about Sets and the functions related to them. Moving on we learnt new notations to describe any mathematical or real-life proposition by using Quantifiers.
- Part 2:in chapter 2, the most essential technique, that I have always been struggling with, which I have learnt is proving any mathematical statement using various methods from direct proofing to mathematical induction.
- Part 3:in chapter3, this chapter broadened my horizon with newest terminology. In addition, I discovered different ways to resemble a relation. For instance, by using a matrix or a data base table.
- Part 4:in chapter4, this chapter I would say was the most interesting chapter for me since I relate to Software department. As far as for the things I have learnt and revised were around the area of analyzing any given algorithm using the three notations mentioned earlier.
- Part 5:After Studying chapter 5 it is now easy to identify basic quantities related to any given number like the Greatest Common Devisor and Least Common Multiple.

[10 Pts] (3) Talk about your coding experience on Ch 4 Algorithms.

[or Why the Proof by Contradiction is considered as a better tool than a direct proof. (8 pts)]

[or Show if $|X| = n$, then $|P(X)| = 2^n$ for all $n \geq 0$. (8 pts)]

① Truth Table을 그려서 명제의 참, 거짓을 나타내고 logical equivalence를 점검할 수 있다. ② Proof by Contradiction을 사용해서 direct하게 prove하기 어려운 명제를 증명할 수 있게 되었다. ③ Algorithm을 통해 Searching과 sorting을 할 수 있게 되었다. ④ 주어진 명제를 수학적으로 나타낼 수 있게 되었다. (ex) $\forall x\, P(x)$). ⑤ De Morgan의 정리를 사용하여 복잡해보이는 명제식(ex) $\neg(\neg p \land q)$)도 풀 수 있다. ⑥ Coding Experience를 통해 proof에 있어서 반례가 존재하면 false를 return하고 모든경우에 대해 for loop을 돌았는데도 반례가 없으면 true를 return하는 방식을 알게 되었다. ⑦ Domain, Co-domain, Range에 대해 정의와 차이점을 말할 수 있다. ⑧ One-to-One function과 Onto에 대해, 그리고 inverse에 대해 설명할 수 있다. ⑨ Relationship의 Matrix를 그릴수있고 $R_2 \circ R_1$을 행렬연산으로 구할 수 있다. ⑩ 수학적 연역법, 귀납법, 귀류법을 사용할 수 있다.

in Ch 4 algorithms, I could understand Big O, Θ, Ω (first). I could implement Bubble Sort. Insertion Sort. (한글로 쓰겠습니다). 즉, 기본적인 Sorting 알고리즘은 implement 해 볼 수 있었습니다. 또 Euclidean Algorithm을 이용해 GCD를 구하는 코드를 짜보고 확장 Euclidean Algorithm을 이용해 modulo inverse를 구해볼 수 있었습니다. 특히 modulo 연산은 asymmetric cipher에서 자주 쓰이는 부분이라 특히 더 관심이 갔습니다. 또 Fermat의 소정리를 이용, 주어진 수가 소수인지 아닌지 판단하는 프로그램도 짜 보았습니다. 보통 n이 소수인지 판단하려면 n을 1부터 $\lfloor \sqrt{n} \rfloor$까지 나누어보는 방법이 있기에 그 방법과 time complexity도 비교해봤습니다.

Talking about my coding experience, I think I contributed alot due to computer exercises I solved since my solutions helped some students to get the concept of the class, especially of Ch 4 Algorithms. At the beginning, I was solving using python programming language but due to exercises and materials provided by professor I learnt Sage coding too.
The most memorable computer exercise program was problem 2 on the page 124. My solution was revised by suggesting more efficient algorithm. Due to it I learnt how important effectiveness of the algorithm is, along with its complexity.

good

Conclusion: I developed my computational thinking while I was solving computer exercises. I learnt new language, Sage.
I realized the properties of any algorithm called effectiveness and generality due to QnA ~~sys~~ system.

```
bool BubbleSearch(int arr[], int first, int last, int key){
    int mid = (first + last)/2;
    if( key == mid){return true}
    else if ( key > mid) { return BubbleSearch(arr, mid+1, last, key);}
    else {return BubbleSearch(arr, first, mid-1, key);}
    return false;
}
```

이 code는 Bubble Search의 알고리즘이다. 이 알고리즘은 재귀함수를 사용하여 반복되는 활동을 빠르고 간편하게 처리할 수 있다. 또한 Search 할 때는 Search의 영역을 분할하고 탐색하는데 분할 할때 빠지는 영역이 없도록 조건을 짜야 한다. 또한 이진 탐색 기법을 통해 똑같은 방법을 여러 영역으로 ~~쪼개~~어서 수행하는 방법이 더 빠르고 효율적으로 탐색 가능하다는 것을 알 수 있다.

Proof The proof is by induction on n.

Basic Step $(n = 0)$ If $n = 0$, X is the empty set.

The only subset of the empty set is the empty set itself; this,

$$|P(X)| = 1 = 2^0 = 2^n.$$

Thus, $|P(X)| = 2^n$ is true for $n = 0$.

Inductive Step **[Assume : $|P(X)| = 2^n$ holds for n.]** **[Show true for $n+1$.]**

Let X be a set with $n+1$ elements. Choose $x \in X$.

Exactly half of the subsets of X contain x, and exactly half of the subset of X do not contain x.

Each subset S of X that contain x can be paired uniquely with the subset obtained by removing x from S.

Thus exactly half of the subsets of X contain x, and exactly half subsets of X do not contain x.

Y is the set obtained from X by removing x, Y has n elements.

By the inductive assumption, $|P(X)| = 2^n$.

But the subsets of Y are precisely the subsets of X that do not contain x.
From the argument in the preceding paragraph, we conclude that

$$|P(Y)| = \frac{|P(X)|}{2}.$$

Therefore

$$|P(X)| = 2|P(Y)| = 2 \cdot 2^n = 2^{n+1}.$$

(4.13) hold for $n+1$ and the inductive step is complete.

By the Principle of Mathematical Induction,

(4.13) holds for all $n \geq 0$.

Part III. [20 Pts] Give your answers in the box. explanations required.

(1) [Ch. 1, P8] (정호진, Muhammed) Assume that a ,b, and c are real numbers. Represent the statement

$a<b$ or ($b<c$ and $a \geq c$)

symbolically, letting

p: $a<b$, q: $b<c$, r: $a<c$.

Solution:

p∨(q∧ㄱ r) ■

(2) Represent the following proposition using only logical symbol you have learned in the class.

The equation $P(x)=0$ does not have a real root. (the real set is written as $\mathbb{R}$).

Answer (There is no x in $\mathbb{R}$ such that $P(x)=0$)

∄! $x \in \mathbb{R}$ ∋ $P(x)=0$ (유사답안 : $\forall x \in \mathbb{R}\ \neg(P(x)=0)$) ■

(3) [Ch 2, P.18] (김희성, 전종문) Compute c_5 when it was

$c_1=0$, $c_n = 2c_{\lfloor n/2 \rfloor} + n$ for all n >1.

Solution

i) $c_2 = 2c_{\lfloor 2/2 \rfloor} + 2$ = 0 + 2 = 2

ii) $c_3 = 2c_{\lfloor 3/2 \rfloor} + 3 = 2c_1 + 3$ = 0 + 3 = 3

iii) $c_4 = 2c_{\lfloor 4/2 \rfloor} + 4 = 2c_2 + 4$ = 4 + 4 = 8

iv) $c_5 = 2c_{\lfloor 5/2 \rfloor} + 5 = 2c_2 + 5$ = 4 + 5 = 9

Answer $c_5 = 9$ ■

(4) [Ch. 5, P5] Write the binary number 10010110 in decimal.

Solution

$$10010110_{(2)} = 0\times2^0 + 1\times2^1 + 1\times2^2 + 0\times2^3 + 1\times2^4 + 0\times2^5 + 0\times2^6 + 1\times2^7$$
$$= 2+4+16+128$$
$$= 150$$

Answer: The binary number $10010110_{(2)}$ is equal to $150_{(10)}$ in decimal. ■

(5) [Ch. 3, P20] (오동찬, Muhammad, 강병훈,) Find the matrix of the relation $R_2 \circ R_1$ when the relations are

$R_1 = \{(1,x), (2,x), (2,y), (3,y)\}$ and $R_2 = \{(x,a), (x,b), (y,a), (y,c)\}$

Solution

The Matrix of $R_1 = \{(1,x), (2,x), (2,y), (3,y)\}$: $A_1 = \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}$

The Matrix of $R_2 = \{(x,a), (x,b), (y,a), (y,c)\}$: $A_2 = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

The product is $A_1 A_2 = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

Thus, the matrix of the relation $R_2 \circ R_1$ is $\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$. ■

Part IV. [20 Pts] Give your a sketch of proof in the box.

(1) [Ch 2, P.16] (오동찬, 정호진) Use mathematical induction to prove the following statement is true for every positive integer n.

$$2^{(n+1)} < 1 + (n+1)2^n$$

Solution

[α step] Basic step:

If $k=1$: $2^2 < 1+2\times 2^1 \Rightarrow 4<5$. So the statement is true for $k=1$.

[β step] Inductive step: Assume that it is true for $k=n$. [Assume $2^{(n+1)} < 1 + (n+1)2^n$ (*)]

[Show it is true for $k=n+1$. Show LHS = $2^{(n+2)} < 1+(n+2)2^{n+1}$ =RHS]

LHS = $2^{(n+2)} = 2 \cdot 2^{(n+1)} < 2\cdot(1+(n+1)2^n)$ (by *)

$= 2+2(n+1)2^n = 2+(n+1)2^{(n+1)} = 1+[1+(n+1)2^{(n+1)}]$

$< 1+[2^{(n+1)} + (n+1)2^{(n+1)}]$ (by $1 < 2^{(n+1)}$)

$= 1+(n+2)2^{(n+1)}$ = RHS

Therefore we have shown that $2^{(n+1)} < 1+(n+1)2^n$.

By mathematical induction, (*) is true for every positive integer n. ■

(2) [Example 3.1.27] Give a sketch of proof : The function $f(n)=4^n-n^4$ from the set of positive integer to the set of positive integer is not one-to-one.

Proof

[Find n_1 and $n_2 \in Z^+$ such that $n_1 \neq n_2$ and $f(n_1)=f(n_2)$.]

$2 \neq 4 \Rightarrow f(2) = 4^2-2^4 = 0 = 4^4-4^4 = f(4)$

Therefore f is not one-to-one.. ■

Comment: In words, a function is not one-to-one if there exist x_1 and x_2 such that $f(x_1)=f(x_2)$ and $x_1 \neq x_2$.

(3) [Example 4.3.3] Give a sketch of proof for that $3n^5+n^4+17n^2+2=\Theta(n^5)$.

Solution

Since

$3n^5+n^4+17n^2+2 \leq 3n^5+n^5+17n^5+2n^5 = 23n^5$ for all $n \geq 1$,

Taking $C_1=23$ in Definition 3.2 to obtain $3n^5+n^4+17n^2+2=O(n^5)$.

Since

$3n^5+n^4+17n^2+2 \geq 3n^5$ for all $n \geq 1$,

Taking $C_2=3$ in Definition 3.2 to obtain $3n^5+n^4+17n^2+2=\Omega(n^5)$.

Therefore,

$3n^5+n^4+17n^2+2=O(n^5)$ and $3n^5+n^4+17n^2+2=\Omega(n^5) \Rightarrow 3n^5+n^4+17n^2+2=\Theta(n^5)$. ■

(4) [Ch5, Example 1.9] Determine whether 43 is prime or not.

Use [Theorem 5.1.7, A positive integer $n>1$ is composite $\Leftrightarrow$ n has a divisor d satisfying $2 \leq d \leq \sqrt{n}$.]

Answer

Check any of 2, 3, 4, 5, 6 $= \lfloor \sqrt{43} \rfloor$ divides 43. (Algorithm 5.1.8 checks!!)

Since none of these numbers divides 43, the condition

$n \bmod d == 0$ is always false.

Therefore, the algorithm returns 0 to indicate that 43 is prime. ■

Part V. [20 Pts] Fall 2018, DM Midterm Exam (Participation) (20 point/100)

Student No.		Name	

<Fill this form, Print it, Bring it and submit it just before your Midterm Exam.>
(시험전에 프린트하여, 빈칸을 채워서 제출하거나, 시험 중에 확인하여 채워서 시험 시간 중에 제출하면 됩니다.)

1. (10 pt) PBL(Problem-Project Based Learning) Participations, (Quantity)

QnA Participations Numbers <Check yourself> : each weekly (From Wed - next Tuesday)

QnA 참여 회수 <QnA에서 직접 확인하세요> : 각 주별 (수요일에서 화요일)

Week 1 : 3 2: 3 3: 3+ 4: 3+

Week 5 : 5+ 6: 5+ 7: 5+ 8: 3

Total# : 30+ (Q: A:)

Online Lecture Participation (온라인 출석 회수): 20+ / 43 (1-8th week)

Off-line Lecture Participation/ Absence (오프라인 출석 8 / 결석 0 회수) (1-8th week)

2. (5 pt) What is your most important contribution or founding that you shared with others in QnA.(Quality)

모하메드 학우가 Benefit of Flipped Learning 글을 쓴 것에 답글을 달았는데, 그 때는 마침 제가 Q&A 활동에 제대로 참여하지 못한 것에 걱정이 되어 교수님께 개인 상담을 받고, Flipped Learning에 대해 갖고 있던 부담감이 덜어짐과 동시에 큰 깨달음을 얻은 직후였기에 놀랍기도 하며 기쁜 마음으로 답글을 달았던 기억이 납니다. 사실 '정답'과 '성적'만이 중요한 입시를 경험하며 알면서도 외면했던 창의성과 주도적 학습의 중요성을 다시 찾은 것 같아 기뻤던 참이었습니다. 그래서 찾아보다보니 Flipped Class와 Flipped Learning의 차이점도 알게 되었는데 교수님께 상담을 요청하지 않았거나 본 수업을 수강하지 않았다면 절대로 알 수 없었던 내용이었습니다. 사실 요즘 세상이 너무 급격하게 변하기에 후일 자식을 낳게 된다면 어떻게 교육해야할까, 멀다면 멀고 가깝다면 가까운 미래에 대한 고민을 해보기도 하는데 Flipped Learning이 그 해답의 일부가 될 수 있을 것 같습니다.

Some from your problems with Final OK by SGLee

3. (5 pt) YOUR PBL(Problem-Project Based Learning) Team/Project (In-depth 심화학습 Participations)

(1) Write names of Team Number/Leader/Members: ... Leader 강병훈 with ... (Ch 6) ...

(2) [Team Members and Project Chapter for each team] Your team will do Project on the following Chapter and will present what you did at the end of November.

[Team 1] Leader 강병훈 with ... (Ch 6)
[Team 2] Leader 전종문 with ... (Ch 7)
[Team 3] Leader 칭기스 with ... (Ch 4 and Ch 5)
[Team 4] Leader 모하메드 with ... (Ch 8)
[Team 5] Leader 오동찬 with ... (Ch 9)
[Team 6] Leader 전솔람 with ... (Ch 1 and Ch2)
[Team 7] Leader 김희성 with ... (Ch 3)
[Independent Team 8] 왕언문 and 백선민,우병화, 유지원,최효기,AYSU,고운위,아난다.

(Write what project you like to do!)

(3) What will be your possible project on the Chapter and your role in your Team (Leader, Idea, Solve, Prove, Coding, Typing, Presentation etc). (Write what you like to do on the Chapter!)

Possible project of our Team: Since the area of our project is **Chapter 4 and Chapter 5** of our discrete mathematics textbook, we decided to create a project, that would have a **close connection with "Algorithms" and "Number Theory."** Therefore, we decided to write a report on the topic **"The important role of Number Theory in Algorithms."** Through our report we want to show the positive effect of Number Theory on Algorithms. And the main goal will be to show that **Number Theory can significantly simplify the process of computing algorithms.**
My role in Team: I took the responsibility to find suitable ideas for our report, and also I will try to prove the tasks solved by our team.

SQSA, 각 팀마다 맡은 Chapter 안의 Solved and Revised 된 문제들을 Final OK 받는 것이 기본이고
그 과정에서 배운 내용들과 관련하여 심화 학습을 하고 그 결과물을 발표하는 것입니다.

4. (1pt, Bonus) Write anything you like to tell me. (What are things that you have learned and recall well from QnA and HW/PBL participation?, 개인/동료와 같이 LA 강좌를 (PBl/Filpped/Action learning) 학습 하면서 배우거나 느낀 점은?)

During the classes of Discrete Mathematics, I developed my computational thinking skills due to chapter 4 and 3(Algorithms, Functions, Sequences and Relations), critical thinking skills due to chapter 1 and 2(Sets and Logic, Proofs) and enlarged my knowledge of Number Theory due to chapter 5. I think these classes were useful for me as a student of software engineering department. From QnA activity I learnt to start learning and working before the class as well as to be quick with problem solving.

QnA활동은 난생 처음 접해보는 것이었기 때문에 처음할 땐 어떻게 해야 하는지 막막하였다. 어떻게 해야 하는 건지 자꾸 교수님에게 물어보고 물어본 내용을 다른 친구들도 아직 모르니까 QnA에 올리고 하다 보니까 점점 어떻게 해야 하는지 감이 잡히게 되었다. 같은 걸 자꾸 물어봐서 귀찮았을 수도 있는데 교수님은 내가 이해할 때까지 계속 설명해주셔서 고마웠다. 이산수학 말고도 확률과 통계를 듣고 있는데 지금은 이산수학의 QnA활동이 확률과 통계 수업 따라가는 것보다 더 수월하다고 느껴진다. 솔직히 처음 적응할 때가 엄청 힘들었지 어떻게 해야 하는지 대충 알게 되니까 얻는 게 더 많은 거 같다. 4강의 시간복잡도도 지금 전공과목인 자료구조개론에서 배우고 있는 내용인데 이산수학 덕분에 쉽게 이해할 수 있었다.

PBL보고서를 작성하면서 내가 이때까지 참여한 문제들에 대해 내가 당시 어떤 생각을 했고 다른 친구들과 무슨 말을 했는지 곱씹어 볼 수 있었다. 다시 한번 복습하는 시간을 가질 수 있어서 시험 준비에 대한 부담이 많이 줄었다. 그리고 당시에는 내가 한 풀이가 정답이라고만 생각하고 있었는데 다른 학우들의 revised/finalized를 통해 내가 많이 부족하다는 사실을 깨달을 수 있었고 겸허하게 이산수학을 공부할 수 있었다. 아마 혼자 공부했다면 분명 잘못 이해했다는 사실도 몰랐을 것이다. 팀을 짜게 되었는데 앞으로 팀 활동도 하면 더 재미있을 것 같아서 기대된다. 물론 할 일이 더 많아 질 수도 있겠지만 아마 팀끼리 협동해서 하는 거니까 부담이 없을 거라 생각한다. 아무래도 팀웍이 좋아야할 것 같다. 팀장으로서 팀웍이 좋은 팀이 되도록 노력해야겠다.

PBL Report를 통해 그동안 제가 Q&A를 얼마나 잘 활용 하였는가, 다른 사람들은 문제를 어떻게 접근하여 푸는가, 미흡한점은 없었나 등을 확인할 수 있었습니다. 또한 학습을 하는 과정에 있어 대부분의 과목은 시험을 보기 위해, 시험준비를 위해 급하게 공부를 하게 되었지만 이번 이산수학은 평소에도 Q&A를 통해 꾸준한 학습이 이루어 졌고 산수가 아닌 수학(數學)을 할 수 있었던 아주 좋은 기회였던 것 같습니다. 기말에는 조금 더 나은 모습을 보여드리도록 노력하겠습니다.

...I will certainly say that after studying chapter one to five am quite confident with my mathematical skills whether it is related to algorithms or proving. Of course, ... Moreover, as a foreigner I want to really appreciate this flipped class system offered by our Professor because it makes us feel more connected to other students and to the Professor himself. Furthermore, I am enthused to see more outcomes of this environment hoping it only gets better and by the end of this semester I hope we will have acquired many skills other than just academic ones. Once again thanks to everyone for making this experience way more effective. 실제로 1st PBL 리포트 제출을 위해 문서를 작성하면서 매 주 조금씩 꾸준히 올렸던 QnA 글들과 문제들의 양을 보며 '내가 이렇게 많이 했었나'라는 생각이 들었습니다. 결또 보고서를 통해 나의 한 일을 정리하고 자신을 되돌아보면서 앞으로 남은 학기를 어떻게 보낼 것인지 어떤 점을 개선해야 될 것인지 파악하게 되었습니다.

[The end!]

Enjoy your wonderful Weekend^^