Homework 1

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1

2

2.1 magic number

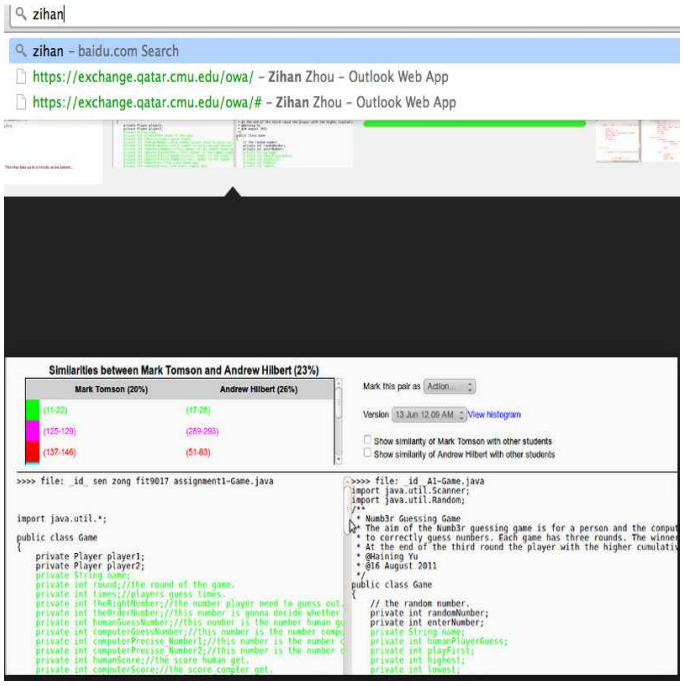
816

2.2 integrity

1. yes, because you should write 4 hours after you discuss
2. no, because they threw the notes and recreate the answer later on
3. yes, because they did not wait for 4 hours
4. For Iliano, yes, because by leaving, he has to erase everything, for Kemal, no because he did not deliberately steal idea from Iliano, he accidently saw it, he can not just pretend not , he still wait for 4 hours, which repects the spirit of policies.
5. Yes, of course this is.

2.3 MOSS

- Moss (for a Measure Of Software Similarity) is an automatic system for determining the similarity of programs. To date, the main application of Moss has been in detecting plagiarism in programming classes.
- of course the least consuming is writing own code unless he do not know how to write it...



- screen shots

Figure 1.

2.4 Example of violation of academic integrity

2.5 Bounus

For every home homework, i receive 12% more, the hw is 50% of all grade, if i get 100% for everyhw, , i got 6% more in the final grade, if 80% for every hw, i got 4.8%

3

3.1 sml running

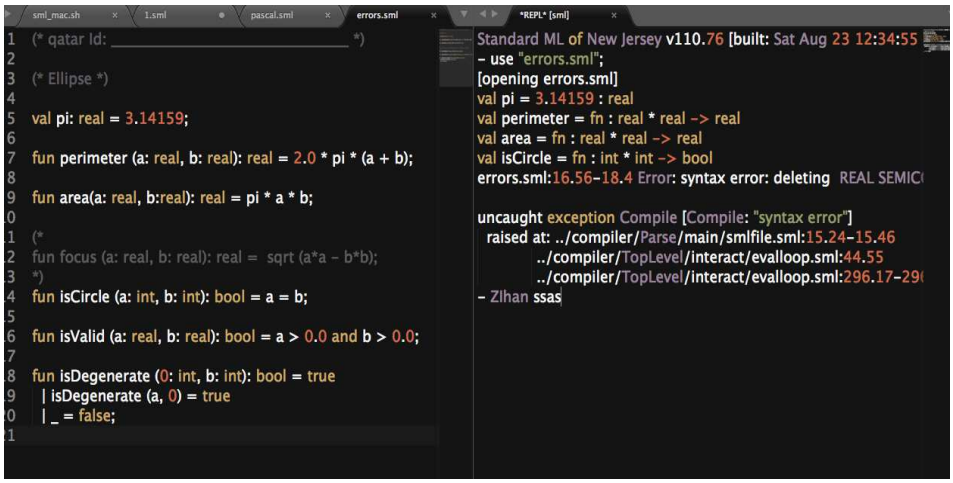


Figure 2.

3.2 other than sml

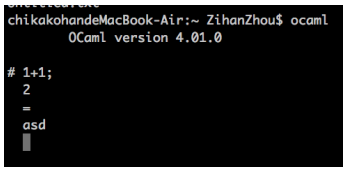


Figure 3.

4 error

4.1

7.42-7.58 Error: operator and operand don't agree [literal]

operator domain: int * int

operand: int * real

in expression:

2 * pi

Answer. because * must take two number with same type, we change 2 to 2.0

4.2

errors.sml:9.5-9.9 Error: can't find function arguments in clause

errors.sml:9.27 Error: unbound variable or constructor: b

errors.sml:9.23 Error: unbound variable or constructor: a

Answer. because `fun area: real = pi * a * b`; this function does not say the type of a and b.

we change to `fun area(a:real,b:real): real = pi * a * b;`

4.3

errors.sml:11.38-11.42 Error: unbound variable or constructor: sqrt

Answer. because we did not load libary math, add line `open Math;` at beginning

4.4

errors.sml:17.56-19.4 Error: syntax error: deleting REAL SEMICOLON FUN

Answer. because you use and. change `and` to `andalso` will fix it

4.5

errors.sml:17.40-17.45 Error: operator and operand don't agree [literal]

operator domain: real * real

operand: real * int

in expression:

a > 0

errors.sml:17.54-17.59 Error: operator and operand don't agree [literal]

operator domain: real * real

operand: real * int

in expression:

b > 0

Answer. because > operator take two same types.. change 0 to 0.0

4.6

errors.sml:21.5 Error: can't find function arguments in clause

errors.sml:21.5 Error: illegal function symbol in clause

errors.sml:19.5-21.14 Error: clauses don't all have same function name

errors.sml:19.5-21.14 Error: right-hand-side of clause doesn't agree with function result type [tycon mismatch]

Answer. two mistake are the function are bool not int. so change int to bool then for the thrid clause change `_=false` to `isDegenerate(a,b)=false`

5

5.1

Answer. not sati. because it requires a bool which will raise error. `binary(true)` will not produce 1 or 0 but rather error.

5.2

Answer. ok.

5.3

Answer. not sati. `binary(0)=0` which is nnot non-zero.

5.4

Answer. ok

5.5

Answer. not sati. `binary(0)=0` which is not positive.

5.6

Answer. choose 5.4, because it is the tightest contract of all.

6

6.1

Proposition 1. *For all natural numbers n,*

$$\sum_{i=0}^{n} 2^i = 2^{n+1} - 1$$

Proof.

by mathematical induction on n.

the proof has two case:

- one base case for $n = 0$
- one inductive case for $n > 0$

Base case $n = 0$:

to show:

$\sum_{i=0}^{0} 2^i = 2^{0+1} - 1$

by math:

$\sum_{i=0}^{0} 2^i = 2^0 = 1 = 2 - 1 = 2^{0+1} - 1$

inductive case: $n = n'+1$:

to show:

$\sum_{i=0}^{n'+1} 2^i = 2^{n'+1+1} - 1$

by IH:

$\sum_{i=0}^{n'} 2^i = 2^{n'+1} - 1$

from left side:

$$\sum_{i=0}^{n'+1} 2^i = \sum_{i=0}^{n'} 2^i + 2^{n'+1} = 2^{n'+1} - 1 + 2^{n'+1} = 2^{n'+2} - 1$$

which equals right side

QED

□

6.2

when b=2, then it is like 6.1

6.3

Proposition 2. *for all natrual numbers b>1 and n,*

$$(b-1)\sum_{i=0}^{n} b^i = b^{n+1} - 1$$

Proof.

by mathmetical induction on n

two case:

- base case : n=0
- inductive case: n>0

Base case: n=0:

to show:

$$(b-1)\sum_{i=0}^{0} b^i = b^{0+1} - 1$$

we know $b > 1 \neq 0$ so $b^0 = 1$:

$$(b-1) \times 1 = b - 1$$

Inducitive case : $n = n' + 1$

To show:

$$(b-1)\sum_{i=0}^{n'+1} b^i = b^{n'+1+1} - 1$$

by ih

$$(b-1)\sum_{i=0}^{n'} b^i = b^{n'+1}-1$$
$$\sum_{i=0}^{n'} b^i = \frac{b^{n'+1}-1}{b-1}$$

left is :

$$\begin{aligned}(b-1)\sum_{i=0}^{n'+1} b^i &= (b-1)\left(\sum_{i=0}^{n'} b^i + b^{n'+1}\right)\\ &= (b-1)\left(\frac{b^{n'+1}-1}{b-1} + b^{n'+1}\right)\\ &= (b-1)\, b^{n'+1} + b^{n'+1} - 1\\ &= b^{n'+2} - 1\\ &= \text{right}\end{aligned}$$

QED

□

6.4

Definition 3. *let P(r,k) denote the Pascal number on r th row and k th col.*

$$\begin{cases} P(r,0) = 1 \\ P(r,r) = 1 & \text{where } k \geqslant 0 \text{ and } r \geqslant 0 \\ P(r,k) = P(r-1,k) + P(r-1,k-1) & \text{where } k < r \end{cases}$$

Definition 4. *so* $\binom{n}{k}$ *=P(n,k)*

6.5

this is by definition...nothing to justify...

6.6

Proposition 5. *for all n and k such that* $0 \leqslant k \leqslant n$,

$$\sum_{j=k}^{n} \binom{j}{k} = \binom{n+1}{k+1}$$

Proof.

by mathematical induction on n.

there are two case: $\begin{cases} \text{base case: } n = k \\ \text{inductive case: } n > 0 \end{cases}$

Base case $n = k$:

to show: $\sum_{j=k}^{k} \binom{j}{k} = \binom{k+1}{k+1}$

left:
$\sum_{j=k}^{k} \binom{j}{k} = \binom{k}{k} = 1 = \binom{k+1}{k+1}$

inductive case $n = n' + 1$

to show:
$\sum_{j=k}^{n'+1} \binom{j}{k} = \binom{n'+1+1}{k+1}$

IH:
$\sum_{j=k}^{n'} \binom{j}{k} = \binom{n'+1}{k+1}$

left:
$\sum_{j=k}^{n'+1} \binom{j}{k} = \sum_{j=k}^{n'} \binom{j}{k} + \binom{n'+1}{k} = \binom{n'+1}{k+1} + \binom{n'+1}{k}$
$= \binom{n'+1+1}{k+1} =$ right

QED

□

6.7

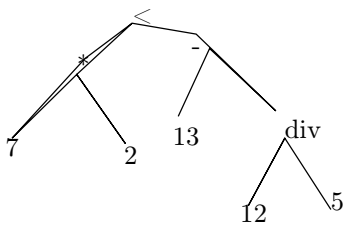
Proposition 6. *for all natrual number n>0*

$$\sum_{k=0}^{n} \binom{n}{k} = 1 + \sum_{i=0}^{n-1} 2^i$$

one line: right side is 2^n by what we proved. left side is the amount of subsets of a set of size n. which is also 2^n so they are equal.

7

7.1 tree



7.2

work 4

span 3

7.3

S=3, W/2=2 so need 3 steps.

7.4

	A	B
t1	12 div 5	
t2	13-	7*2
t3		<

7.5

2n because each of n landry take 1 dry and 1 clean

7.6

2hours

span is 2.

washing them all and dry them all