**Principles of Programming Languages**

Assignment 4

1. Which statement is true:
   * + 1. false, is of type T1, receives T1 and returns T2, takes as input T1 and not T2.
       2. true, receives 1 argument of type T2 and returns T1.
       3. false, there is no information on the left side about , could be the wrong type. The exp returns T2 and not .
       4. false, there is no information on the left side about , could be the wrong type. T2 could be a number, but the exp returns T3 and not .
2. Perform type inference algorithm for the expression:
3. Rename bound vars: .
4. Assign type vars for every sub expression:

|  |  |
| --- | --- |
| Expression | Variable |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1. Construct type equations:

|  |  |
| --- | --- |
| Expression | Equation |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1. Solve the equations:

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Step 1: .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Step 2: both sides are composite that needs to be split.

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |
|  |

Step 3: .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |

Step 4: split.

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |
|  |

Step 5: substituted .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |

Step 6: substituted .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |

Step 7: first substituted to , then substituted each equation that has with .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |

Step 8: substituted with .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |

Step 9: substituted with , we will get  
 and delete it from the left side.

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |

Step 10: first substituted with , then we will get   
 and substituted each equation that has with .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |

The inference succeeds the type of .



1. Rename bound vars: .
2. Assign type vars for every sub expression:

|  |  |
| --- | --- |
| Expression | Variable |
|  |  |
|  |  |
|  |  |
|  |  |
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|  |  |

1. Construct type equations:

|  |  |
| --- | --- |
| Expression | Equations |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1. Solve the equations:

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Step 1: .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |

Step 2: both sides are composite that needs to be split.

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
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|  |
|  |

Step 3: .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |
|  |

Step 4: substituted .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |
|  |

Step 5: substituted .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |
|  |

Step 6: substituted .

|  |  |
| --- | --- |
| Equation | Substitution |
|  |  |
|  |
|  |

Step 7: , FAILED, cannot be a composite expression.