

CSE 341: Programming Languages

Autumn 2005
Lecture 10 — Free Variables and Argument Substitution -
Mini-Exercises

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Free Variables - Mini-Exercise 1

What are the free variables in the following ML expressions?

```
a+b;
```

```
let val y=10
in
  x+y+10
end;
```

Free Variables - Mini-Exercise 2

What are the free variables in the following ML expression?

```
let val x=1;
    val y=x+z
in
  let val y=10;
      val z=20;
in
  w+x+y+z
end
end;
```

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Argument Substitution - Mini-Exercise 1

Use the rule that $(\text{fn } x \Rightarrow e1) e2$ is equivalent to $e3$ where $e3$ is $e1$ with every x replaced by $e2$ (with some restrictions!)

For example, $(\text{fn } x \Rightarrow x+y) 3$ is equivalent to $3+y$

For each of these cases, either give the result of applying the rule, or say that it isn't possible (and why).

```
(fn x => x + let val x=100 in x+y end) 3
```

```
(fn x => let val y=100 in x+y end) y
```

```
(fn x => 42) (1 div 0)
```

```
(fn x => x+x+x) (horrible 100000)
```

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