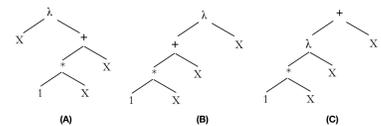


1. Starting with an empty stack, what sequence of operations will yield the string **MIRE** from the incoming string **LIMERICK**. *Note:* It is acceptable for there to still be characters on the stack and/or on the incoming string when your output is complete.

- A OOOXXOOXXX
- B OOOXXXOOXX
- C OOXOXOOXX
- D OOOXXOOXX
- E OOOXXOOOX

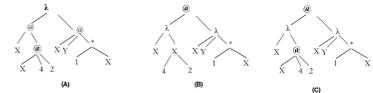
2. Which of the following ASTs is equivalent to  $(\lambda x. + (* 1 x) x)$ ?

- A
- B
- C



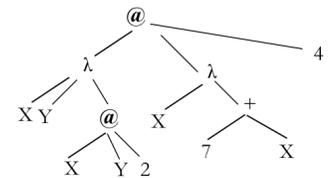
3. Which AST is equivalent to  $(\lambda x. x 4 2) (\lambda xy. * 1 x)$ ?

- A
- B
- C



4. What is the equivalent lambda expression for this AST?

- A  $(\lambda x. + 7 x) (\lambda xy. * x y) 4$
- B  $(\lambda xy. * x y) (\lambda x. + 7 x) 4$
- C  $(\lambda x. + 7 x) (\lambda xy. x y 2) 4$
- D  $(\lambda xy. x y 2) (\lambda x. + 7 x) 4$
- E  $(\lambda xy. x 4 2) (\lambda x. + 7 x) 4$



5. What does this lambda expression evaluate to?  $((\lambda xyz. y x z) 1 / 3)$

- A 3
- B 1/3
- C .33
- D 9
- E 1/9

6. x  
(define x 3)  
(define y 4)  
(define x ((lambda (x) (+ x x)) y))

- A 3
- B 4
- C 8
- D 6
- E 7
- F x is a function

7. What is the value for x after the following code is executed in Racket?

```
(define x 1)
(define y 2)
(define z 3)
(define addy (lambda (z) (+ z y)))
(define messy (lambda (x z) (+ (addy z) (addy x))))
(messy (addy x) (addy z))
```

- A 3
- B 2
- C 1
- D 12
- E 6

8. Given the following expression, which statements are true?

( (lambda (x) (x y z) ) (lambda (z) (y z)))

- A x occurs free; y occurs free; z occurs both free and bound.
- B x occurs free; y occurs both free and bound; z occurs bound.
- C x occurs bound; y occurs both free and bound; z occurs bound.
- D x occurs bound; y occurs bound; z occurs bound.
- E x occurs bound; y occurs free; z occurs both free and bound.

9. Given the following expression, which statement is true?

(lambda (y) (lambda (x) (x y)) (lambda (z) (z y))) y

- A x occurs bound; y occurs free; z occurs bound.
- B x occurs bound; y occurs both free and bound; z occurs bound.
- C x occurs free; y occurs free; z occurs free.
- D x occurs bound; y occurs bound; z occurs bound.
- E x occurs both free and bound; y occurs both free and bound; z occurs both free and bound.