Do not turn this page until you have received the signal to start.
(In the meantime, please fill out the identification section above,
and read the instructions below.)

This test consists of 4 questions on 6 pages (including this one). When you receive the signal to start, please make sure that your copy of the test is complete.

Please answer questions in the space provided. You will earn 20% for any question you leave blank or write “I cannot answer this question,” on. You will earn substantial part marks for writing down the outline of a solution and indicating which steps are missing.

Good Luck!
QUESTION 1. [9 marks]

Do the following calculations between base ten (decimal) and base two (binary):

PART (A) [3 marks]

Convert base ten 53 to base two. Briefly explain your procedure.

PART (B) [3 marks]

Convert base two 1011011 to base ten. Briefly explain your procedure.

PART (C) [3 marks]

Add the base two numbers 1110 and 10111 (without converting them to base ten).
Show your work (i.e. when you “carry” a 1).
Question 2. [10 marks]

Assume the expressions below have been typed into the definitions pane of DrRacket, preceded by `(require picturing-programs)`. Below each parenthesized expression write, draw, or describe its effect when the “Run” button is clicked.

```lisp
(apply * (map sqrt (list 1 4 9 16)))
```

```lisp
(circle
  (apply + (map string-length
              (list "how" "now" "brown" "cow"))) "solid" "green")
```

```lisp
(first (rest (reverse (rest (list 0 1 2 3 4 5))))))
```

```lisp
(or
  (> (string-length "five") (string-length "four"))
  (equal? (length (list 1 2 4)) 3))
```

```lisp
(apply <
  (map image-width
       (list (triangle 7 "solid" "green") (square 5 "outline" "blue"))))
```
QUESTION 3. [10 MARKS]

Read the definition of the mystery function \( (p \ n) \) below.

\[
; p : \text{number} \rightarrow \text{string} \\
\text{(define (p n)} \\
\quad (\text{cond } [(\text{zero? n}) \ "o"] \\
\quad \quad [\text{else (string-append}} \\
\quad \quad \quad "\<" \\
\quad \quad \quad (p (- n 1)) \\
\quad \quad \quad (p (- n 1)) \\
\quad \quad \quad ";")])])
\]

PART (A) [4 MARKS]

Write check-expect expressions for \( (p \ 0) \) and \( (p \ 1) \).

PART (B) [6 MARKS]

Show the results of running \( (p \ 2) \) and \( (p \ 3) \).
Briefly explain your steps.
QUESTION 4.  [10 marks]
Assume these two expressions have been typed into the definitions pane of DrRacket.

(require picturing-programs)

(define a-bird)

The following asks you to complete some check-expects, and write two functions.
Do not manually draw any images by hand.

PART (A)  [2 marks] Here are two check-expects for function box. Complete the second one.

(\begin{tabular}{l}
  (check-expect (box ) ) \\
  (check-expect (box ) ) \\
\end{tabular})

PART (B)  [3 marks] Write the function box:

\begin{verbatim}
; box : image -> image \\
; Produce the image with a square around it of the same height.
(define
\end{verbatim}

PART (C)  [2 marks] Here are six check-expects for function zone. Complete the two incomplete ones.

\begin{tabular}{l}
  (check-expect (zone 0) (circle 25 "outline" "black")) \\
  (check-expect (zone 1) ) ; the circle has radius 25 \\
  (check-expect (zone 1) ) \\
  (check-expect (zone 2) ) \\
  (check-expect (zone 2) ) \\
  (check-expect (zone 3) )
\end{tabular}

PART (D)  [3 marks] Write the function zone:

\begin{verbatim}
; zone : number -> image \\
(define (zone n)
\end{verbatim}
CSC 104H1
TERM TEST #2
March 2014

# 1: _____/9
# 2: _____/10
# 3: _____/10
# 4: _____/10

TOTAL: _____/39

Page 6 of 6
END OF EXAM