

I first read in the “cs3-black-jack.scm” file into the interpreter. I then defined the procedure for each question in the interpreter. As can be seen, I then traced the procedures I defined before calling them.

Question 1

```
> (trace best-hand)
> (best-hand '((A d) (8 h)))
| > (best-hand '((A d) (8 h)))
| 19
19
```

A is equal to 11.

```
> (best-hand '((A d) (8 h) (5 s)))
| > (best-hand '((A d) (8 h) (5 s)))
| 14
14
```

A is equal to 1.

```
> (best-hand '((A d) (8 h) (A s)))
| > (best-hand '((A d) (8 h) (A s)))
| 20
20
```

The first A is equal to 11 and the second A is equal to 1.

Question 2

```
> (trace stop-at)
> ((stop-at 17) '((A d) (8 h)) '(5 s))
| > (stop-at 17)
| #<procedure #3>
| > (best-hand '((A d) (8 h)))
| 19
#f
```

#f is returned because 19 is greater than 17

```
> ((stop-at 17) '((6 d) (8 h)) '(5 s))
| > (stop-at 17)
| #<procedure #4>
| > (best-hand '((6 d) (8 h)))
| 14
#t
```

#t is returned because 14 is less than 17

```
> ((stop-at 19) '((A d) (7 h)) '(5 s))
| > (stop-at 19)
| #<procedure #5>
| > (best-hand '((A d) (7 h)))
| 18
#t
```

#t is returned because 18 is less than 19

Question 3

```
(trace repeat-game)
> (repeat-game (stop-at 18) 3)
| > (stop-at 18)
| #<procedure #9>
| > (repeat-game '#<procedure #9> 3)
| | > (best-hand '((A s) (2 d)))
| | 13
| | > (best-hand '((A s) (2 d)))
| | 13
| | > (best-hand '((5 s) (A s) (2 d)))
| | 18
| | > (best-hand '((5 s) (A s) (2 d)))
| | 18
| | > (best-hand '((5 s) (A s) (2 d)))
| | 18
| | > (best-hand '((J s)))
| | 10
| | > (best-hand '((Q d) (J s)))
| | 20
| | > (best-hand '((Q d) (J s)))
| | 20
| | > (best-hand '((5 s) (A s) (2 d)))
| | 18
| | > (best-hand '((Q d) (J s)))
| | 20
| | > (best-hand '((10 h) (5 h)))
| | 15
| | > (best-hand '((10 h) (5 h)))
| | 15
| | > (best-hand '((K s) (10 h) (5 h)))
| | 25
| | > (best-hand '((K s) (10 h) (5 h)))
| | 25
| | > (best-hand '((2 h) (J h)))
| | 12
| | > (best-hand '((2 h) (J h)))
| | 12
| | > (best-hand '((10 c) (2 h) (J h)))
| | 22
| | > (best-hand '((10 c) (2 h) (J h)))
| | 22
| -3
-3
```

The game was played 3 times with (stop-at 18) as the strategy. The player lost all 3 times.

```

> (repeat-game (stop-at 17) 4)
| > (stop-at 17)
| #<procedure #10>
| > (repeat-game '#<procedure #10> 4)
| | > (best-hand '((10 d) (6 d)))
| | 16
| | > (best-hand '((10 d) (6 d)))
| | 16
| | > (best-hand '((3 h) (10 d) (6 d)))
| | 19
| | > (best-hand '((3 h) (10 d) (6 d)))
| | 19
| | > (best-hand '((3 h) (10 d) (6 d)))
| | 19
| | > (best-hand '((7 s)))
| | 7
| | > (best-hand '((4 d) (7 s)))
| | 11
| | > (best-hand '((J d) (4 d) (7 s)))
| | 21
| | > (best-hand '((J d) (4 d) (7 s)))
| | 21
| | > (best-hand '((3 h) (10 d) (6 d)))
| | 19
| | > (best-hand '((J d) (4 d) (7 s)))
| | 21
| | > (best-hand '((A d) (5 s)))
| | 16
| | > (best-hand '((A d) (5 s)))
| | 16
| | > (best-hand '((7 s) (A d) (5 s)))
| | 13
| | > (best-hand '((7 s) (A d) (5 s)))
| | 13
| | > (best-hand '((10 c) (7 s) (A d) (5 s)))
| | 23
| | > (best-hand '((10 c) (7 s) (A d) (5 s)))
| | 23
| | > (best-hand '((K h) (8 d)))
| | 18
| | > (best-hand '((K h) (8 d)))
| | 18
| | > (best-hand '((K h) (8 d)))
| | 18
| | > (best-hand '((Q d)))
| | 10
| | > (best-hand '((7 h) (Q d)))
| | 17
| | > (best-hand '((7 h) (Q d)))
| | 17
| | > (best-hand '((K h) (8 d)))
| | 18
| | > (best-hand '((7 h) (Q d)))
| | 17
| | > (best-hand '((K h) (8 d)))
| | 18
| | > (best-hand '((7 h) (Q d)))
| | 17
| | > (best-hand '((K d) (5 c)))
| | 15
| | > (best-hand '((K d) (5 c)))
| | 15
| | > (best-hand '((Q d) (K d) (5 c)))
| | 25
| | > (best-hand '((Q d) (K d) (5 c)))
| | 25
| -2
-2

```

The game was played 4 times with (stop-at 17) as the strategy. The player lost 3 times and won once

Question 4

```
> (trace clever)
> (clever '((5 c) (4 d)) '(9 h))
| > (clever '((5 c) (4 d)) '(9 h))
| #t
#t
```

Returns #t because the player has 11 or less.

```
> (clever '((K c) (8 d)) '(9 h))
| > (clever '((K c) (8 d)) '(9 h))
| #f
#f
```

Returns #f because the player has 17 or greater.

```
> (clever '((5 c) (7 d)) '(5 h))
| > (clever '((5 c) (7 d)) '(5 h))
| #f
#f
```

Returns #f because the player has 12 and the dealer has 4, 5, or 6.

```
> (clever '((5 c) (7 d)) '(7 h))
| > (clever '((5 c) (7 d)) '(7 h))
| #t
#t
```

Returns #t because the player has 12 and the dealer does not have 4, 5, or 6.

```
> (clever '((5 c) (8 d)) '(9 h))
| > (clever '((5 c) (8 d)) '(9 h))
| #t
#t
```

Returns #t because the player has between (including) 13 and 16 or less and dealer has 7 or greater or an ace.

```
> (clever '((5 c) (8 d)) '(A h))
| > (clever '((5 c) (8 d)) '(A h))
| #t
#t
```

Returns #t because the player has between (including) 13 and 16 or less and dealer has 7 or greater or an ace.

```
> (clever '((5 c) (8 d)) '(6 h))
| > (clever '((5 c) (8 d)) '(6 h))
| #f
#f
```

Returns #f because the player has between (including) 13 and 16 or less and dealer does not have 7 or greater or an ace.

Question 5

```
> (trace majority)
> ((majority (stop-at 19) (stop-at 17) (stop-at 13)) '((Q d) (5 h)) '(8 s))
| > (stop-at 19)
| #<procedure #11>
| > (stop-at 17)
| #<procedure #12>
| > (stop-at 13)
| #<procedure #13>
| > (majority '#<procedure #11> '#<procedure #12> '#<procedure #13>)
| #<procedure #14>
| > (best-hand '((Q d) (5 h)))
| 15
| > (best-hand '((Q d) (5 h)))
| 15
#t
```

Returns function that returns #t because 2 out of 3 arguments return #t

```
> ((majority (stop-at 19) clever (stop-at 13)) '((Q d) (5 h)) '(6 s))
| > (stop-at 19)
| #<procedure #15>
| > (stop-at 13)
| #<procedure #16>
| > (majority '#<procedure #15> '#<procedure #17 clever> '#<procedure #16>)
| #<procedure #18>
| > (best-hand '((Q d) (5 h)))
| 15
| > (clever '((Q d) (5 h)) '(6 s))
| #f
| > (best-hand '((Q d) (5 h)))
| 15
| > (best-hand '((Q d) (5 h)))
| 15
| > (clever '((Q d) (5 h)) '(6 s))
| #f
#f
```

Returns function that returns #f because 2 out of 3 arguments return #f

Question 6

(This is all one long trace)

```
> (get-stats clever 4 3)
| > (get-stats '#<procedure #17 clever> 4 3)
| | > (best-hand '((9 c) (Q c)))
| | 19
| | > (clever '((9 c) (Q c)) '(Q d))
| | #f
| | > (best-hand '((9 c) (Q c)))
| | 19
| | > (best-hand '((Q d)))
| | 10
| | > (best-hand '((J d) (Q d)))
| | 20
| | > (best-hand '((J d) (Q d)))
| | 20
| | > (best-hand '((9 c) (Q c)))
| | 19
| | > (best-hand '((J d) (Q d)))
| | 20
| | > (best-hand '((6 c) (9 h)))
| | 15
```

```
| | > (clever '((6 c) (9 h)) '(6 d))
| | #f
| | > (best-hand '((6 c) (9 h)))
| | 15
| | > (best-hand '((6 d)))
| | 6
| | > (best-hand '((6 h) (6 d)))
| | 12
| | > (best-hand '((5 s) (6 h) (6 d)))
| | 17
| | > (best-hand '((5 s) (6 h) (6 d)))
| | 17
| | > (best-hand '((6 c) (9 h)))
| | 15
| | > (best-hand '((5 s) (6 h) (6 d)))
| | 17
| | > (best-hand '((2 s) (Q c)))
| | 12
| | > (clever '((2 s) (Q c)) '(9 c))
| | #t
| | > (best-hand '((J h) (2 s) (Q c)))
| | 22
| | > (best-hand '((J h) (2 s) (Q c)))
| | 22
| | > (best-hand '((3 d) (6 h)))
| | 9
| | > (clever '((3 d) (6 h)) '(J d))
| | #t
| | > (best-hand '((9 s) (3 d) (6 h)))
| | 18
| | > (clever '((9 s) (3 d) (6 h)) '(J d))
| | #f
| | > (best-hand '((9 s) (3 d) (6 h)))
| | 18
| | > (best-hand '((J d)))
| | 10
| | > (best-hand '((5 s) (J d)))
| | 15
| | > (best-hand '((5 h) (5 s) (J d)))
| | 20
| | > (best-hand '((5 h) (5 s) (J d)))
| | 20
| | > (best-hand '((9 s) (3 d) (6 h)))
| | 18
| | > (best-hand '((5 h) (5 s) (J d)))
| | 20
| | > (best-hand '((6 c) (4 h)))
| | 10
| | > (clever '((6 c) (4 h)) '(J s))
| | #t
| | > (best-hand '((4 d) (6 c) (4 h)))
| | 14
| | > (clever '((4 d) (6 c) (4 h)) '(J s))
| | #t
| | > (best-hand '((5 c) (4 d) (6 c) (4 h)))
| | 19
| | > (clever '((5 c) (4 d) (6 c) (4 h)) '(J s))
| | #f
| | > (best-hand '((5 c) (4 d) (6 c) (4 h)))
| | 19
| | > (best-hand '((J s)))
| | 10
| | > (best-hand '((2 h) (J s)))
| | 12
| | > (best-hand '((K s) (2 h) (J s)))
| | 22
| | > (best-hand '((K s) (2 h) (J s)))
| | 22
| | > (best-hand '((Q d) (6 c)))
| | 16
| | > (clever '((Q d) (6 c)) '(9 s))
```

```

| | #t
| | > (best-hand '((10 c) (Q d) (6 c)))
| | 26
| | > (best-hand '((10 c) (Q d) (6 c)))
| | 26
| | > (best-hand '((2 h) (Q h)))
| | 12
| | > (clever '((2 h) (Q h)) '(10 c))
| | #t
| | > (best-hand '((5 s) (2 h) (Q h)))
| | 17
| | > (clever '((5 s) (2 h) (Q h)) '(10 c))
| | #f
| | > (best-hand '((5 s) (2 h) (Q h)))
| | 17
| | > (best-hand '((10 c)))
| | 10
| | > (best-hand '((Q c) (10 c)))
| | 20
| | > (best-hand '((Q c) (10 c)))
| | 20
| | > (best-hand '((5 s) (2 h) (Q h)))
| | 17
| | > (best-hand '((Q c) (10 c)))
| | 20
| | > (best-hand '((5 d) (3 d)))
| | 8
| | > (clever '((5 d) (3 d)) '(6 s))
| | #t
| | > (best-hand '((K c) (5 d) (3 d)))
| | 18
| | > (clever '((K c) (5 d) (3 d)) '(6 s))
| | #f
| | > (best-hand '((K c) (5 d) (3 d)))
| | 18
| | > (best-hand '((6 s)))
| | 6
| | > (best-hand '((5 c) (6 s)))
| | 11
| | > (best-hand '((Q d) (5 c) (6 s)))
| | 21
| | > (best-hand '((Q d) (5 c) (6 s)))
| | 21
| | > (best-hand '((K c) (5 d) (3 d)))
| | 18
| | > (best-hand '((Q d) (5 c) (6 s)))
| | 21
| | > (best-hand '((7 d) (3 h)))
| | 10
| | > (clever '((7 d) (3 h)) '(K d))
| | #t
| | > (best-hand '((10 h) (7 d) (3 h)))
| | 20
| | > (clever '((10 h) (7 d) (3 h)) '(K d))
| | #f
| | > (best-hand '((10 h) (7 d) (3 h)))
| | 20
| | > (best-hand '((K d)))
| | 10
| | > (best-hand '((3 d) (K d)))
| | 13
| | > (best-hand '((6 h) (3 d) (K d)))
| | 19
| | > (best-hand '((6 h) (3 d) (K d)))
| | 19
| | > (best-hand '((10 h) (7 d) (3 h)))
| | 20
| | > (best-hand '((6 h) (3 d) (K d)))
| | 19
| | > (best-hand '((10 h) (7 d) (3 h)))
| | 20

```

```

| | > (best-hand '((6 h) (3 d) (K d)))
| | 19
| | > (best-hand '((5 d) (6 s)))
| | 11
| | > (clever '((5 d) (6 s)) '(J h))
| | #t
| | > (best-hand '((9 d) (5 d) (6 s)))
| | 20
| | > (clever '((9 d) (5 d) (6 s)) '(J h))
| | #f
| | > (best-hand '((9 d) (5 d) (6 s)))
| | 20
| | > (best-hand '((J h)))
| | 10
| | > (best-hand '((6 d) (J h)))
| | 16
| | > (best-hand '((8 h) (6 d) (J h)))
| | 24
| | > (best-hand '((8 h) (6 d) (J h)))
| | 24
| | > (best-hand '((10 s) (5 h)))
| | 15
| | > (clever '((10 s) (5 h)) '(2 d))
| | #f
| | > (best-hand '((10 s) (5 h)))
| | 15
| | > (best-hand '((2 d)))
| | 2
| | > (best-hand '((3 s) (2 d)))
| | 5
| | > (best-hand '((6 h) (3 s) (2 d)))
| | 11
| | > (best-hand '((6 s) (6 h) (3 s) (2 d)))
| | 17
| | > (best-hand '((6 s) (6 h) (3 s) (2 d)))
| | 17
| | > (best-hand '((10 s) (5 h)))
| | 15
| | > (best-hand '((6 s) (6 h) (3 s) (2 d)))
| | 17
| | > (best-hand '((6 d) (J d)))
| | 16
| | > (clever '((6 d) (J d)) '(K c))
| | #t
| | > (best-hand '((6 s) (6 d) (J d)))
| | 22
| | > (best-hand '((6 s) (6 d) (J d)))
| | 22
| (-4 -2 0)
(-4 -2 0)

```

Returns a list of three elements, with each being the number of wins minus losses of four individual games each, using the clever strategy.

Question 8

```
1> (trace hit?)
1> (black-jack hit?)
| > (best-hand '((8 s) (10 s)))
| 18
| > (hit? '((8 s) (10 s)) '(K c))
Player hand: ((8 s) (10 s))
Dealer face-up card: (K c)
Player total: | | > (best-hand '((8 s) (10 s)))
| | 18
18
Would you like to take a hit? (type y for yes and n for no) n
| #f
| > (best-hand '((8 s) (10 s)))
| 18
| > (best-hand '((K c)))
| 10
| > (best-hand '((4 d) (K c)))
| 14
| > (best-hand '((5 c) (4 d) (K c)))
| 19
| > (best-hand '((5 c) (4 d) (K c)))
| 19
| > (best-hand '((8 s) (10 s)))
| 18
| > (best-hand '((5 c) (4 d) (K c)))
| 19
-1
```

Asked the user if the user would like to hit after informing the user that the player score is 18. The user decided to not hit and subsequently loses the game.

```

1> (black-jack hit?)
| > (best-hand '((6 d) (6 s)))
| 12
| > (hit? '((6 d) (6 s)) '(K d))
Player hand: ((6 d) (6 s))
Dealer face-up card: (K d)
Player total: | | > (best-hand '((6 d) (6 s)))
| | 12
12
Would you like to take a hit? (type y for yes and n for no) y
| #t
| > (best-hand '((8 s) (6 d) (6 s)))
| 20
| > (hit? '((8 s) (6 d) (6 s)) '(K d))
Player hand: ((8 s) (6 d) (6 s))
Dealer face-up card: (K d)
Player total: | | > (best-hand '((8 s) (6 d) (6 s)))
| | 20
20
Would you like to take a hit? (type y for yes and n for no) n
| #f
| > (best-hand '((8 s) (6 d) (6 s)))
| 20
| > (best-hand '((K d)))
| 10
| > (best-hand '((2 s) (K d)))
| 12
| > (best-hand '((2 d) (2 s) (K d)))
| 14
| > (best-hand '((4 h) (2 d) (2 s) (K d)))
| 18
| > (best-hand '((4 h) (2 d) (2 s) (K d)))
| 18
| > (best-hand '((8 s) (6 d) (6 s)))
| 20
| > (best-hand '((4 h) (2 d) (2 s) (K d)))
| 18
| > (best-hand '((8 s) (6 d) (6 s)))
| 20
| > (best-hand '((4 h) (2 d) (2 s) (K d)))
| 18
1

```

Asked the user if the user would like to hit after informing the user that the player score is 12. The user decided to hit. The user got a '(6 s) card, bringing the player total to 20. The user then decides to not hit and subsequently wins the game.