

1 Instructions

In this assignment, you will be required to write JavaScript functions that simplify playing of the variation of [UNO](#)

1.1 Data File Specification

test03.uno

```
(  
[  
[('g','6'),('y','8'),('g','3'),('g','d'),('r','4'),('w','-')],  
[('g','5'),('w','d'),('g','5'),('y','8'),('b','0'),('b','9')]  
]  
,  
[(('r',''),('w','d'),('r','2'),('b','2'),('g','r'),('b','8'),('b',  
,('g','d'),('r','8'),('y','s'),('b','s'),('w',  
,('-'),('y','r'),('g','1'),('b','3'),('y','1'),('b','1'),('r','r',  
,('y','s'),('g','2'),('y','4'),('b','4'),('g','9'),('b','2'),('y',  
,('g','8'),('r','2'),('y','3'),('b','9'),('y','9'),('g',  
,('0'),('g','6'),('y','s'),('g','s'),('y','4'),('b','r'),('y',  
,('1'),('r','6'),('y','d'),('r','7'),('g','9'),('b','d'),('r',  
,('2'),('g','4'),('y','6'),('r','r'),('g','7'),('b','r'),('r',  
,('5'),('r','4'),('b','2'),('w','c'),('y','5'),('r',  
,('9'),('r','d'),('b','5'),('y','6'),('r','s'),('y','d'),('b',  
,('4'),('y','3'),('g','8'),('b','1'),('g','1'),('b','s'),('w','d',  
,('r','1'),('b','s'),('r','6'),('w','-'),('r','8'),('w','d'),('b',  
,('7'),('y','9'),('y','2'),('g','7'),('b','d'),('b','3'),('b',  
,('5'),('y','2'),('y','6'),('r','5'),('b','6'),('g','2'),('r',  
,('9'),('g','3'),('g','s'),('g','4'),('y','r'),('b','8'),('r','d',  
,(''))]  
,  
[(('r','7'),('r','0'),('r','3')]  
)
```

Figure 1: A properly formatted game encoding

2 One Player, One Move

The first part (`onePlayerOneMove` in the file `csce322h0mework03part01.hs`) will take in three (3) arguments (a discard pile, a deck, and a hand) and return the state of the game (hand/deck/discard) that is the result of the player in possession of the hand playing a card. The precedence for playing a card is as follows:

1. Extend a Wild Draw 4 if that is the most recently played (left-most) card (behind a `r,-`, `g,-`, `b,-`, or `y,-`)
2. Extend a Draw 2 if that is the most recently played card (not behind a `r,-`, `g,-`, `b,-`, or `y,-`)
3. Play the left-most card that matches the color of the most recently played card in the discard pile
4. Play the left-most Wild Draw 4
5. Play the left-most card that matches the symbol of the most recently played card in the discard pile
6. Play the left-most Wild
7. Draw (add to the back of the hand) the left-most card in the deck

If playing a Wild (or Wild Draw 4), the next player needs to know which color to play next. If the hand still contains non-Wild cards, play the card `c,-` (where `c` is the color of the left-most non-Wild card remaining in the hand). If the hand only contains Wild cards play `r,-`. If the hand has been emptied (and, therefore, the game won), play `-, -`.

In the event that you need to extend a Wild Draw 4 or Draw 2 and cannot, you must draw all of the cards (possibly) built-up from other players extending Wild Draw 4s or Draw 2s. If a Draw 4 was played, it would be directly behind a `r,-`, `g,-`, `b,-`, or `y,-`. Once you draw the number of cards required (or the size of the deck, whichever is smaller), place a copy of the a `r,-`, `g,-`, `b,-`, or `y,-` from the front of the discard pile on the front of the discard pile. This will let future players know that they must continue with a card of that color.

part01test01.uno

part01test01.uno

```
(
[
[('y','2'),('g','d'),('r','9'),('b','6'),('w','d'),('w','-'),('b',
  '6')],
[('g','6'),('y','1'),('r','1'),('r','7'),('r','6'),('g','9'),('b',
  '5')]
],
,
[('r','r'),('b','0'),('b','d'),('w','d'),('b','7'),('b','8'),('b',
  '2'),('g','4'),('r','5'),('g','9'),('r','3'),('b','2'),('b','r',
  ' '),('r','0'),('g','r'),('y','2'),('b','4'),('y','5'),('g','0'),('r',
  'w','d'),('r','7'),('g','7'),('b','8'),('r','d'),('b','9'),('r',
  '9'),('r','s'),('b','s'),('b','r'),('y','8'),('r','2'),('y',
  '4'),('b','s'),('g','3'),('r','3'),('y','3'),('g','5'),('y',
  '1'),('g','s'),('r','1'),('y','4'),('g','8'),('b','d'),('b',
  '7'),('g','1'),('g','2'),('g','5'),('g','2'),('r','8'),('b',
  '3'),('w','-'),('r','8'),('y','r'),('r','5'),('g','4'),('r',
  '2'),('b','5'),('y','6'),('y','0'),('y','7'),('g','d'),('y','s',
  ' '),('r','4'),('r','1'),('b','1'),('b','1'),('y','r'),('y','s'),('r','d'),('y',
  '5'),('y','9'),('b','4'),('y','3'),('b','9'),('w','d'),('b',
  '1'),('y','d'),('y','8'),('g','8'),('y','7'),('g','r'),('r',
  '4'),('g','3'),('w','1'),('y','6'),('y','1'),('w','-'),('r',
  '6'),('y','9'),('g','b'),('g','1'),('g','7'),('g','s'),('r','s',
  '')]
,
[('b','3')]
)
```

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part01test01.solution

```
"Result"
"Hands"
"[y2][gd][r9][wd][w-][b6]"
""
"Discard"
"[b6][b3]"
"Deck"
"[rr][b0][bd][wd][b7][b8][b2][g4][r5][g9][r3][b2][br][r0][gr][y2][b4]
[y5][g0][wd][r7][g7][b8][rd][b9][r9][rs][bs][br][y8][r2][y4][bs]
[g3][r3][y3][g5][y1][gs][r1][y4][g8][bd][b7][g1][g2][g5][g2][r8]
[b3][w-][r8][yr][r5][g4][r2][b5][y6][y0][y7][gd][ys][r4][rr][b1]
[yr][ys][rd][y5][y9][b4][y3][b9][wd][b1][yd][y8][g8][y7][gr][r4]
[g3][w-][y6][yd][w-][r6][y9][g6][g1][g7][gs][rs]"
```

3 One Player, Many Moves

The second part (`onePlayerManyMoves` in the file `csce322h0mework03part02.hs`) will take in three (3) arguments (a discard pile, a deck, and a hand), and returns the hand/deck/discard that is the result of the player in possession of the hand playing as many cards in a row as they can before emptying their hand or being unable to continue playing cards. The same rules for precedence of moves as `onePlayerOneMove` applies.

part02test01.uno

```
(  
[  
[('y','5'),('g','8'),('y','5'),('b','7'),('g','3'),('g','6'),('r',  
  '5')],  
[('y','d'),('w','d'),('y','4'),('g','r'),('r','s'),('b','4'),('b','s',  
  ')],  
[('y','1'),('b','3'),('y','6'),('b','4'),('g','d'),('r','6'),('y',  
  '9')]  
],  
,
```

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```
[('r','s'),('r','2'),('b','0'),('r','7'),('r','d'),('r','3'),('g',
',1'),('b','2'),('b','5'),('y','3'),('r','7'),('r','r'),('b',
',6'),('r','4'),('b','9'),('b','r'),('r','3'),('g','5'),('w',
',-'),('b','s'),('b','9'),('w','d'),('g','8'),('r','9'),('y','s',
'),('r','4'),('g','2'),('b','5'),('r','1'),('g','5'),('w','d'),('g',
',0'),('g','s'),('g','r'),('g','3'),('g','7'),('g','9'),('b','d',
'),('r','8'),('y','7'),('b','7'),('g','9'),('w','-'),('y','8'),('g',
',2'),('b','1'),('y','4'),('y','9'),('y','2'),('w','-'),('g','d',
'),('r','5'),('g','7'),('g','1'),('g','6'),('y','2'),('g','4'),('y',
',r'),('r','6'),('y','s'),('r','d'),('y','1'),('w','-'),('r',
',1'),('y','r'),('w','d'),('r','8'),('y','d'),('y','8'),('b',
',1'),('y','3'),('r','r'),('b','6'),('b','8'),('b','r'),('y',
',0'),('b','d'),('r','9'),('y','6'),('y','7'),('b','2'),('r',
',2'),('g','s'),('g','4'),('b','3'),('r','0')]
,
[('b','8')]
)
```

part02test01.solution

```
"Result"
"Hands"
""
""
"Discard"
"[br][b9][b6][b5][b1][w-][r4][rr][r7][r3][y3][y5][y5][g5][g1][g6][g8
][g3][r3][r-][rd][r7][rs][r5][r2][b2][b0][b7][b8]"
"Deck"
"[bs][b9][wd][g8][r9][ys][r4][g2][r4][r1][w-][d][g0][gs][gr][g3][g7
][g9][bd][r8][y7][b7][g9][w-][y8][g2][b1][y4][y9][y2][w-][gd][r5
][g7][g1][g6][y2][g4][yr][r6][ys][rd][y1][w-][r1][yr][wd][r8][yd
][y8][b1][y3][rr][b6][b8][br][y0][bd][r9][y6][y7][b2][r2][gs][g4
][b3][r0]"
```

4 Many Players , One Move

The third part (`manyPlayersOneMove` in the file `csce322h0mework03part03.hs`) will take in three (3) arguments (a discard pile, a deck, and a list of hands) and return the game (hands/deck/discard) that is the result of n turns being taken for a game with n players. The same rules for precedence apply, but skip and reverse cards will have these effects: if Player p plays a reverse on turn t , Player $p - 1$ will take turn $t + 1$ (or Player n will take turn $t + 1$ if Player 1 played the reverse) assuming the turns are proceeding in ascending order. If turns are proceeding in descending order Player $p + 1$ will take turn $t + 1$ (or Player 1 will take turn $t + 1$ if Player n played the reverse). If Player p plays a skip on turn t , Player $p + 2$ will take turn $t + 1$ (or Player 1 will take turn $t + 1$ if Player $n - 1$ played the skip, or Player 2 will take turn $t + 1$ if Player n played the skip) if turns are proceeding in ascending order. If turns are proceeding in descending order, Player $p - 2$ will take turn $t + 1$ (or Player $n - 1$ will take turn $t + 1$ if Player 1 played the skip, or Player n will take turn $t + 1$ if Player 2 played the skip).

part03test01.uno

```
(
[
[('r','r'),('y','4'),('r','4'),('r','0'),('g','0'),('b','6'),('y','d'
)],
[('r','5'),('b','4'),('b','8'),('b','5'),('w','-'),('r','2'),('y','d'
)],
[('b','5'),('b','r'),('y','6'),('b','r'),('g','5'),('g','2'),('g'
','8')],
[('b','7'),('y','6'),('r','d'),('r','7'),('r','5'),('b','9'),('y'
','0')],
[('y','2'),('b','9'),('y','3'),('y','7'),('g','1'),('y','8'),('w'
','-')],
[('g','3'),('b','3'),('y','1'),('r','3'),('w','d'),('g','r'),('y'
','5')],
[('b','s'),('g','6'),('b','6'),('g','8'),('g','s'),('r','r'),('b'
','7')]
],
[('g','4'),('r','r'),('b','4'),('g','2'),('r','8'),('y','3'),('b','d'
'),('g','7'),('r','6'),('y','2'),('g','1'),('y','8'),('r','1'),('b'
','d'),('g','5'),('g','r'),('g','6'),('r','6'),('y','9'),('w','d'
'),('r','4'),('r','1'),('w','d'),('g','9'),('w','-'),('w','-'),('y'
','r'),('r','5'),('r','3'),('w','2'),('b','0'),('g','d'
'),('b','8'),('y','4'),('y','9'),('b','2'),('g','d'),('r','s'),('b'
','1'),('y','5'),('r','3'),('g','3'),('r','9'),('g','9'),('y','s'
'),('g','s'),('w','d'),('y','1'),('g','4'),('r','7'),('r','1'),('r'
','d'),('g','r'),('w','s'),('r','s'),('w','s'),('y','7')]
],
[('b','3')]
)
```

part03test01.solution

```
"Result "  
"Hands "  
"[rr][y4][r4][r0][g0][yd] "  
"[r5][b8][b5][w-][r2][yd] "  
"[br][y6][br][g5][g2][g8] "  
"[y6][rd][r7][r5][b9][y0] "  
"[y2][y3][y7][g1][y8][w-] "  
"[g3][y1][r3][wd][gr][y5] "  
"[g6][b6][g8][gs][rr][b7] "  
""  
"Discard "  
"[bs][b3][b9][b7][b5][b4][b6][b3] "  
"Deck "  
"  
[g4][yr][b4][g2][r8][y3][bd][g7][r6][y2][g1][y8][b1][bd][g5][gr][g6  
][r6][y9][wd][r4][r1][wd][g9][w-][w-][yr][r8][r9][r2][b2][b0][gd  
][b8][y4][ys][r2][gd][rs][b1][r3][r3][r3][g9][rs][gs][wd][y1  
][g4][r7][r1][rd][g7][ys][rs][bs][y7] "
```

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5 Many Players , Many Moves

The fourth part (`manyPlayersManyMoves` in the file `csce322h0mework03part04.hs`) will take in three (3) arguments (a discard pile, a deck, and hands) and return the game (hands/deck/discard) that is the result of a game being played to its conclusion. Instead of n players combining to take n turns, turns will be taken following the rules of `manyPlayersOneMove` until a player empties their hand or the player whose turn it is cannot continue the game (either by playing a card or drawing a card from the deck).

part04test01.uno

```
(
[
[('r','8'),('r','d'),('r','2'),('g','r'),('b','4'),('y','5'),('g',
  '6')],
[('g','8'),('g','4'),('y','7'),('r','4'),('b','1'),('y','r'),('g','r',
  'r')],
[('b','d'),('y','4'),('y','1'),('g','1'),('b','4'),('b','9'),('y',
  '3')],
[('b','r'),('y','d'),('b','7'),('y','9'),('y','1'),('y','d'),('g',
  '5')],
[('b','5'),('r','3'),('r','1'),('s','4'),('g','s'),('g','9'),('g',
  '7')],
[('g','s'),('y','3'),('g','2'),('r','6'),('y','4'),('g','5'),('b',
  '6')],
[('y','7'),('b','3'),('r','2'),('g','5'),('b','5'),('r','3'),('r',
  '1')],
[('y','6'),('r','r'),('b','0'),('y','s'),('g','d'),('g','7'),('b','s',
  'r')],
[('b','d'),('w','d'),('w','d'),('b','2'),('r','8'),('y','r',
  'r')],
],
[('r','3'),('y','s'),('y','2'),('w','d'),('g','9'),('b','r'),('t',
  '2'),('g','d'),('g','3'),('r','s'),('b','5'),('w','d'),('y',
  '2'),('g','8'),('r','s'),('b','3'),('r','9'),('r','6'),('g',
  '2'),('r','r'),('r','9'),('r','5'),('b','8'),('b','7'),('y',
  '0'),('y','5'),('r','7'),('y','6'),('w','d'),('b','s'),('w',
  '-'),('y','8'),('r','5'),('b','6'),('r','7'),('g','1'),('g',
  '3'),('r','0'),('r','d'),('w','-'),('y','8'),('g','6'),('b',
  '9'),('w','-')],
],
[('g','0')]
```


part04test01.solution

```
"Result"
"Hands"
"[r8][r2][b4][y5][g6][y2][g8][rs][b3][r9][r6]"
"[g8][g4][y7][r4][b1][yr][gr][b2][g3][rs]"
"[y4][y1][g1][b4][b9][y3][b5]"
"[b7][y9][y1][yd][g5][wd]"
"[g4][gs][g9][g7][g9]"
"[gs][g2][y4][g5][br]"
"[y7][b5][r1]"
"[y6][ys][gd][g7][bs][r3][ys][y2]"
"[r4][b2][r8][yr]"
""
"Discard"
"[wd][w-][g-][gd][bd][yd][y9][y3][r3][rr][r2][r6][r1][r-][rd][bd][b0
][b1][br][b8][b6][b3][b-][b-][wd][gr][g0]"
"Deck"
"[g2][rr][r9][r5][b8][b7][y0][y5][r7][y6][wd][bs][w-][y8][r5][b6][r7
][g1][g3][r0][rd][w-][y8][g6][b9][w-]"
```

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6.1 Helpers.hs

A file named `Helpers.hs` has been provided with the functionality to read the `.uno` files into matrices. If a modified `Helpers.hs` file is not included with your submission, the default will be used in its place.

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