

Name: _____

Directions: Show all work. No credit for answers without work. Unless otherwise specified, you may leave your answers in terms of factorials and binomial/multinomial coefficients.

1. How many ways are there to rearrange the letters in the word 'MINIMUM':

(a) [**2 points**] with no additional restrictions?

(b) [**2 points**] so that no two M's are consecutive? For example, 'MINIMUM' counts but 'MINIUMM' and 'INIUMMM' does not.

(c) [**1 point**] so that the 'U' is placed between the two 'I's, not necessarily consecutively? For example, 'MINUIMM' counts but 'MINIMUM' does not.

2. [1 point] A carnival has a prize system where each token can be redeemed for a prize. There are 11 prizes available. Irene has won 3 prize tokens. Assuming she wants three different prizes, how many ways are there for her to redeem her tokens? **Express your answer as a simplified, concrete number.**
3. [2 parts, 2 points each] Poker hands. Recall that a standard deck has 52 cards: one for each suit/rank pair, where the 4 suits are spades, hearts, diamonds, clubs and the 13 ranks are ace, 2 through 10, jack, queen, and king. A poker hand is a set of 5 cards from the deck.
- (a) How many poker hands have all distinct ranks? For example, the hand $\{4S, 6S, 8S, 10H, QD\}$ counts but $\{4S, 6S, 6C, 10H, QD\}$ does not.
- (b) A *face card* is a card whose rank is jack, queen, or king. How many poker hands have at least 1 face card? For example the hand $\{4S, 6S, 8S, 10H, QD\}$ counts but $\{4S, 6S, 6C, 10H, AD\}$ does not.