Midterm practice

Name: _____

Question 1: `R` code interpretation

Consider this `R` code.

```
my_func <- function(x, w){
  sum(x*w)
}
```

(1a) What will the output of `my_func(x = c(1,3,5), w = c(.5, .3, .2))` be?

(1b) What will the output of the following code chunk be?

```
y <- c(1,0,1)
x <- c(1,3,5)
w <- c(.5, .3, .2)
my_func(x = x[y == 1], w = w[y == 1])
```

Question 2: Proof interpretation

Theorem: For random variable X and $a \in \mathbb{R}$, $V[aX] = a^2 V[X]$.

Proof:

$$
\begin{aligned}
V[aX] &= E[(aX - E[aX])^2] && \text{(Step 1)} \\
&= E[(aX - aE[X])^2] && \text{(Step 2)} \\
&= E[a^2(X - E[X])^2] && \text{(Step 3)} \\
&= a^2 E[(X - E[X])^2] && \text{(Step 4)} \\
&= a^2 V[X] && \text{(Step 5)}
\end{aligned}
$$

Explain what definition/property/operation is being used in each step of the proof.

(2a) Step 1:

(2b) Step 2:

(2c) Step 3:

(2d) Step 4:

(2e) Step 5:

(2f) Explain in words what $V[aX] = a^2 V[X]$ means.

Question 3: Joint distribution of two random variables

Consider the joint PMF of two random variables, X and Y:

x	y	$f(x, y)$
0	0	1/4
0	1	1/5
1	0	1/5
1	1	1/10
1	2	1/4

(3a) What is the marginal distribution of X, i.e. $f_X(x)$?

x	$f_X(x)$
0	
1	

(3b) What is the expectation of X, i.e. $E[X]$?

(3c) What is the standard deviation of X, i.e. $\sigma[X]$?

(3d) What is the conditional distribution of Y given X, i.e. $f_{Y|X}(y \mid x)$?

x	y	$f_{Y\|X}(y \mid x)$
0	0	
0	1	
1	0	
1	1	
1	2	