ECS 315: In-Class Exercise # 7 Solution

Instructions

1. Separate into groups of no more than three persons. Only one submission is needed for each group. **The group cannot be the same as any of your former groups.**
2. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
3. **Do not panic.**

Date: 12 / 10 / 2017			
Name	ID (last 3 digits)		
Prapun	5	5	5

Consider the outcome from a random experiment in which you roll a 10-sided fair dice.
We define the following random variables from the outcomes of this experiment:

$$X(\omega)=\omega \qquad \text{and} \qquad Y(\omega)=(\omega-7)^2.$$

(a) Find the sample space Ω for this experiment.

See next page if you start with "0".

$\Omega = \{1,2,3,\ldots,10\}$

Note that because the dice is fair,

$$P(\{\omega\}) = \frac{1}{|\Omega|} = \frac{1}{10} \text{ for any } \omega \in \Omega.$$

(b) Find $P[X=7]$.

Recall that we use square brackets to define an event from a statement about RV.

$$[X=7] = \{\omega \in \Omega : X(\omega) = 7\} = \{7\}$$

$$P[X=7] = P([X=7]) = P(\{7\}) = \frac{1}{10}$$

(c) [M2016Q10]
Find $P[Y>10]$.

Because $|\Omega|=10$, it is easy to simply test each value of ω by plugging-in to $(\omega-7)^2$

ω	$\omega-7$	$(\omega-7)^2$
1	−6	36
2	−5	25
3	−4	16
4	−3	9
5	−2	4
6	−1	1
7	0	0
8	1	1
9	2	4
10	3	9

Note that $Y(\omega)>10 \equiv (\omega-7)^2>10$

$\equiv \omega \in \{1,2,3\}$

Therefore, $[Y>10] = \{1,2,3\}$

and

$$P[Y>10] = P(\{1,2,3\})$$
$$= P(\{1\}) + P(\{2\}) + P(\{3\})$$
$$= \frac{1}{3}+\frac{1}{3}+\frac{1}{3}$$
$$= \frac{3}{10} = 0.3.$$

Alternatively, from $(\omega-7)^2>10$, we must have

$\omega-7 > \sqrt{10}$ or $\omega-7 < -\sqrt{10}$

$\omega > 7+\sqrt{10}$ $\qquad$ $\omega < 7-\sqrt{10}$

$\omega > 10.1623$ $\qquad$ $\omega < 3.8377$

⇓ none of the ω in Ω satisfies this

⇓ $\omega = 1,2,3$

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Consider the outcome from a random experiment in which you roll a 10-sided fair dice.
We define the following random variables from the outcomes of this experiment:

$$X(\omega)=\omega \qquad \text{and} \qquad Y(\omega)=(\omega-7)^2.$$

(a) Find the sample space Ω for this experiment.

$\Omega = \{0,1,2,\ldots,9\}$

Note that because the dice is fair,

$$P(\{\omega\}) = \frac{1}{|\Omega|} = \frac{1}{10} \text{ for any } \omega \in \Omega.$$

(b) Find $P[X=7]$.

Recall that we use square brackets to define an event from a statement about RV.

$$[X=7] = \{\omega \in \Omega : X(\omega) = 7\} = \{7\}$$

$$P[X=7] = P([X=7]) = P(\{7\}) = \frac{1}{10}$$

(c) [M2016Q10]
Find $P[Y>10]$.

Note that $Y(\omega)>10 \equiv (\omega-7)^2 > 10$

$\equiv \omega \in \{0,1,2,3\}$

Therefore, $[Y>10] = \{0,1,2,3\}$

and

$$P[Y>10] = P(\{0,1,2,3\})$$
$$= P(\{1\}) + P(\{1\}) + P(\{2\}) + P(\{3\})$$
$$= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$
$$= \frac{4}{10} = 0.4.$$

Because $|\Omega|=10$, it is easy to simply test each value of ω by plugging-in to $(\omega-7)^2$

ω	$\omega-7$	$(\omega-7)^2$
0	−7	49
1	−6	36
2	−5	25
3	−4	16
4	−3	9
5	−2	4
6	−1	1
7	0	0
8	1	1
9	2	4

Alternatively, from $(\omega-7)^2 > 10$, we must have

$\omega - 7 > \sqrt{10}$ or $\omega - 7 < -\sqrt{10}$

$\omega > 7+\sqrt{10}$ $\qquad$ $\omega < 7-\sqrt{10}$

$\omega > 10.1623$ $\qquad$ $\omega < 3.8377$

⇓ none of the ω in Ω satisfies this

⇓ $\omega = 0,1,2,3$