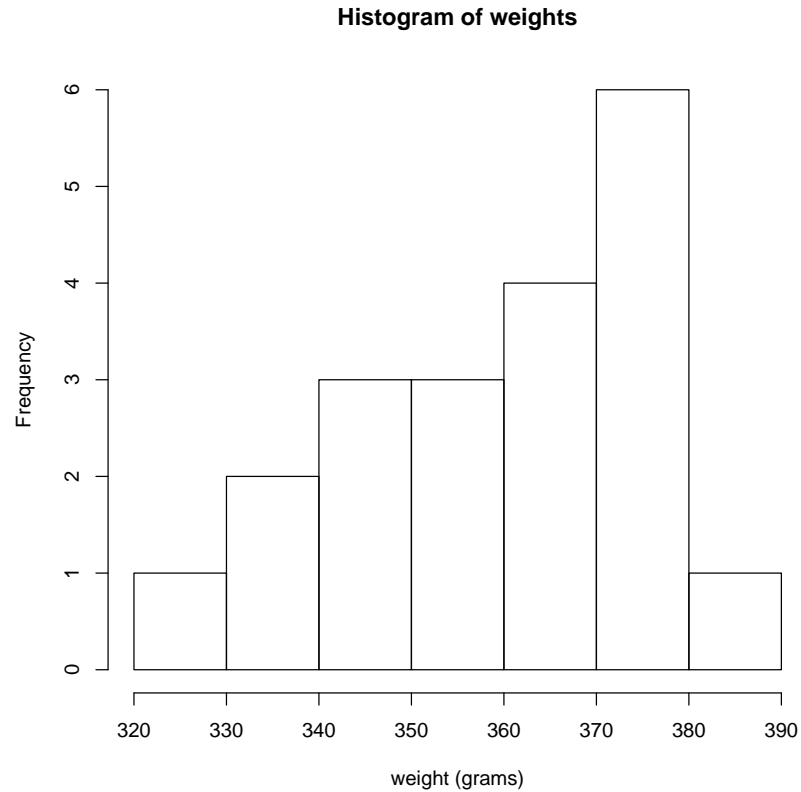


1. Multiple Choice.

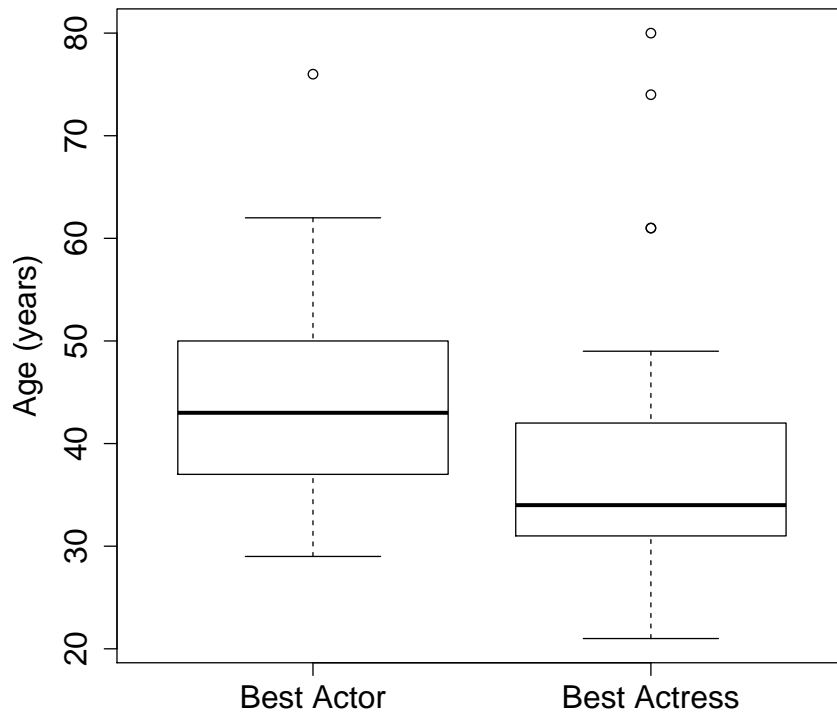
- (a) The weights of a certain item are shown in the histogram below. Which statement(s) below is(are) true about the distribution of weight data?



Check all that apply.

- ☐ More than 75% of the weights fall between 330 and 370 grams
- ☐ The mean is between 370 and 380 grams
- ☐ The value of the $\frac{\text{median}}{\text{mean}}$ ratio is greater than 1
- ☐ None of the above

- (b) The side-by-side boxplots below show the distributions of ages for male and female Academy Award winners from 1977 to 2009. Which statement(s) below is(are) true about the distribution of age?



- | | | |
|------|-------|----------------------------------------------------------------------------------------------------|
| True | False | The median age for winning male actors is higher than the median age for winning female actresses. |
| True | False | The distribution for winning female actresses is left skewed. |
| True | False | Approximately 75% of winning male actors are between 37 and 50 years old. |

For the following questions, please circle the most appropriate response.

- (c) Let $A = \{\text{Draw a red card from a regular deck of 52 cards}\}$, and $B = \{\text{Draw an ace from a regular deck of 52 cards}\}$. Then the events A and B are:
- I. disjoint
 - II. independent
 - III. complements
 - IV. none of the above
- (d) The number of defective parts produced each hour by a certain production line has the following probability distribution:

Number of defective parts (x)	0	1	2	3	4
$P(X = x)$	0.15	0.30	0.25	0.20	0.10

Suppose it is known that there were more than 2 defective parts produced in a particular hour. What is the probability that the number of defective parts was fewer than 4?

- I. 0.10
 - II. 0.36
 - III. 0.67
 - IV. 0.90
 - V. None of the above
- (e) The length of a metal rod is a random variable with mean 150m and standard deviation 2m. The mean (in m) and variance (in m^2) of the total length of five randomly chosen metal rods will be:
- I. Mean = 150, Variance = 10
 - II. Mean = 750, Variance = 10
 - III. Mean = 150, Variance = 20
 - IV. Mean = 750, Variance = 20
 - V. Mean = 750, Variance = 100
- (f) Consider tossing a coin 3 times, and define the following events: $A = \{\text{Toss 3 heads in a row}\}$ and $B = \{\text{Toss a head, then a tail, then a head}\}$. Choose one of the following answers.
- I. $P(A) > P(B)$
 - II. $P(A) = P(B)$
 - III. $P(A) < P(B)$
 - IV. Not enough info to tell

Short Answer. Please show all your work. Be sure to define variables, state models used and check assumptions where appropriate.

2. A process for making a particular type of alloy yields up to 1 ton of alloy a day. The actual amount produced, Y is a random variable because of machine breakdowns and various slowdowns. Suppose Y has the following pdf

$$f(y) = \begin{cases} 2y & 0 \leq y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

The company is paid \$300 per ton of alloy, but there is also a fixed overhead cost of \$100 per day. Let U be the company's daily profit (in hundreds of dollars).

- (a) Find the probability density function of U .

- (b) What is the company's expected daily profit?

3. A manufacturing company performs risk assessments to try to prevent worker injuries. Workers' tasks are classified as low risk, medium risk and high risk. From previous records, 32% of tasks are low risk, 47% are medium risk and 21% are high risk. In a given year, the probability of a worker having an accident is 0.11 for a low risk task, 0.23 for a medium risk task and 0.44 for a high risk task.

(a) What is the probability that a randomly selected worker will have an accident?

(b) What is the probability that a randomly selected worker performs a medium risk task and does not have an accident?

(c) If a randomly selected worker is known to have had an accident, what is the probability that they were performing a low risk task?

4. A computer manufacturer offers a one year warranty. If the computer fails for any reason during this period, it is replaced. The time to failure is modelled by an exponential distribution with a mean of 4 years.

(a) Find the median time to failure.

(b) What percentage of computers will fail within the warranty period?

5. Suppose X and Y are two independent random variables, where $X \sim U(5, 10)$ and $Y \sim U(7, 10)$. Let $W = \min(X, Y)$. Find $E(W)$.