SOLUTIONS

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Section A: Multiple Choice Questions

1. **(b)** $1 - p$
   The sum of the probability of an event and its complement is always 1. Thus, $P(E) + P(\text{not } E) = 1 \implies P(\text{not } E) = 1 - p$.

2. **(b)** -1.5
   Probability $P(E)$ always lies in the range $0 \leq P(E) \leq 1$. It cannot be negative.

3. **(a)** $1/2$
   Prime numbers on a die are $\{2, 3, 5\}$. Total outcomes $= 6$. Probability $= 3/6 = 1/2$.

4. **(d)** $2/3$
   Total balls $= 3 + 5 + 7 = 15$. Non-black balls $= 3 + 7 = 10$. $P(\text{not black}) = 10/15 = 2/3$.

5. **(b)** 0.545
   Number of tails $= 1000 - 455 = 545$. Experimental probability $= 545/1000 = 0.545$.

6. **(c)** 0.63
   $P(\text{not } E) = 1 - P(E) = 1 - 0.37 = 0.63$.

7. **(a)** $13/40$
   $P(\text{not like}) = 65/200$. Dividing both by 5: $13/40$.

8. **(b)** 1
   The sum of probabilities of all elementary events of an experiment is always 1.

Section B: Very Short Answer Questions

1. Total trials $= 500$.
   $P(\text{Head}) = \frac{245}{500} = 0.49$.
   $P(\text{Tail}) = \frac{255}{500} = 0.51$.

2. **Sample Space:** The set of all possible outcomes of a random experiment.
   For two coins: $S = \{HH, HT, TH, TT\}$.

3. Total bulbs $= 80$. Defective $= 10$. Non-defective $= 80 - 10 = 70$.
   $P(\text{not defective}) = \frac{70}{80} = \frac{7}{8}$.

4. No, the experimental probability cannot be greater than 1 because the frequency of an event can never exceed the total number of trials.

Section C: Short Answer Questions

1. Total trials = 1000.

   (i) Outcomes less than 3 are $\{1, 2\}$. Frequency $= 179 + 150 = 329$. $P(< 3) = \frac{329}{1000} = 0.329$.

   (ii) Even numbers are $\{2, 4, 6\}$. Frequency $= 150 + 149 + 190 = 489$. $P(\text{even}) = \frac{489}{1000} = 0.489$.

2. Total sectors = 8.

   (i) Prime numbers: $\{2, 3, 5, 7\}$. Total $= 4$. $P(\text{prime}) = \frac{4}{8} = \frac{1}{2}$.

   (ii) Divisible by 3: $\{3, 6\}$. Total $= 2$. $P(\text{div by 3}) = \frac{2}{8} = \frac{1}{4}$.

3. Total tosses = 200.

   (i) $P(\text{exactly 2 heads}) = \frac{72}{200} = \frac{9}{25} = 0.36$.

   (ii) At least 2 heads = (2 heads) or (3 heads) $= 72 + 23 = 95$. $P(\text{at least 2}) = \frac{95}{200} = \frac{19}{40} = 0.475$.

Section D: Long Answer Questions

1. Total days = 250.

   (a) $P(\text{correct}) = \frac{175}{250} = \frac{7}{10} = 0.7$.

   (b) $P(\text{not correct}) = 1 - 0.7 = 0.3$.

   (c) Expected wrong days $= P(\text{not correct}) \times 30 = 0.3 \times 30 = 9$ days.

2. Area of circle $= \pi r^2$.

   (i) Area inner (shaded) $= \pi(5)^2 = 25\pi$. Total Area $= \pi(10)^2 = 100\pi$.
   $P(\text{inner}) = \frac{25\pi}{100\pi} = \frac{1}{4} = 0.25$.

   (ii) Area outer ring = Total Area - Inner Area $= 100\pi - 25\pi = 75\pi$.
   $P(\text{outer ring}) = \frac{75\pi}{100\pi} = \frac{3}{4} = 0.75$.

Case Study Solutions

1. **(c) Experimental (Empirical) Probability** (Based on observed data).

2. **(a) 35** (Total packages 500 - 425 perfect - 40 scuffed = 35 damaged).

3. **(d) 85/100** (425/500 = 85/100 = 0.85).

4. **(b) 160** (Probability of scuffs = 40/500 = 0.08. For 2000 packages: $2000 \times 0.08 = 160$).

5. **(c) Sum = 1** (The sum of probabilities of all outcomes in an experiment is always 1).