clc; clear; close all;

% Given data

total\_families = 800;

num\_children = 4;

p\_boy = 0.5; % Probability of a child being a boy

p\_girl = 0.5; % Probability of a child being a girl

% Binomial distribution function: P(X = k) = nchoosek(n,k) \* p^k \* (1-p)^(n-k)

% (i) Families with 2 boys and 2 girls (X = 2)

p\_2b2g = nchoosek(num\_children, 2) \* (p\_boy^2) \* (p\_girl^2);

families\_2b2g = total\_families \* p\_2b2g;

% (ii) Families with at least 1 boy (X ≥ 1)

p\_0b = (p\_girl)^num\_children; % Probability of all girls (0 boys)

p\_atleast1b = 1 - p\_0b;

families\_atleast1b = total\_families \* p\_atleast1b;

% (iii) Families with at most 2 girls (X ≤ 2)

p\_0g = (p\_boy)^num\_children; % Probability of all boys (0 girls)

p\_1g = nchoosek(num\_children, 1) \* (p\_boy^3) \* (p\_girl^1); % Probability of 1 girl

p\_2g = nchoosek(num\_children, 2) \* (p\_boy^2) \* (p\_girl^2); % Probability of 2 girls

p\_atmost2g = p\_0g + p\_1g + p\_2g;

families\_atmost2g = total\_families \* p\_atmost2g;

% (iv) Families with children of both sexes (at least 1 boy and 1 girl)

p\_both\_sexes = 1 - (p\_0b + p\_0g); % Excluding all-boys or all-girls cases

families\_both\_sexes = total\_families \* p\_both\_sexes;

% Display results

fprintf('Expected number of families with:\n');

fprintf('- 2 boys and 2 girls: %.0f\n', families\_2b2g);

fprintf('- At least 1 boy: %.0f\n', families\_atleast1b);

fprintf('- At most 2 girls: %.0f\n', families\_atmost2g);

fprintf('- Children of both sexes: %.0f\n', families\_both\_sexes);