Task1

1.Calculate the selection probability of the worst solution for the case of *N* = 10 (population size) and *K* = 2 (tournament size) “with duplication”.

$$P = \frac{1}{10} * \frac{1}{10} = \frac{1}{100}$$

Reason: With duplication, the probability of the worst solution being selected is 1/10 (because there are 10 solutions, and one is selected each time), as the selection is random, and we make two selections.

2.Calculate the selection probability of the *i*-th worst solution for the case of *N* = 10 (population size) and *K* = 2 (tournament size) “with duplication”..

$$P\,i \;= (\frac{i}{10})^2 - (\frac{i-1}{10})^2 = \frac{2i-1}{100}$$

Reason: With duplication, the number of solutions not better than the i-th worst solution is i. So the number of solutions selected that are not better than the i-th worst solution is i/N. Because K equals 2, and we also need to subtract the cases that do not include the i-th worst solution (i-1)/N.

3.Calculate the selection probability of the *i*-th worst solution for the case of *N* = 10 (population size) and *K* = 3 (tournament size) “with duplication”.

$$Pi = (\frac{i}{10})^3 - (\frac{i-1}{10})^3 = \frac{(3i^2 - 3i + 1)}{1000}$$

Reason: It is similar to second question.

Task2

In evolutionary computation, I believe the best generation update mechanism among the following mechanisms is (μ, λ)ES: The standard comma strategy ($\lambda > \mu > 1$). Here are the reasons for my choice:

1. **Integration of Multiple Advantages**:
    - (μ, λ)ES combines the strengths of both ($\mu + \mu$)ES and ($1 + \lambda$)ES. With μ maintaining population diversity and λ providing additional exploration, this combination enables a more comprehensive balance between exploration and exploitation.
2. **Flexibility and Adjustability**:
    - The parameters μ and λ in (μ, λ)ES are flexible and adjustable to adapt to different types of problems and available computational resources. By tuning μ and λ, the algorithm can find the optimal balance between exploration and exploitation, leading to more effective convergence towards the optimal solution.
3. **Maintenance of Population Diversity**:

    - By employing the comma strategy, ($\boldsymbol{\mu}$, $\boldsymbol{\lambda}$)ES preserves a certain number of parents in each generation, thereby maintaining population diversity. This is crucial for avoiding local optima and enhancing global search capabilities.
4. **Improved Convergence Speed**:
    - Due to its ability to maintain population diversity while providing effective exploration, ($\boldsymbol{\mu}$, $\boldsymbol{\lambda}$)ES often converges to the optimal solution more quickly. Compared to other mechanisms, it can utilize current information more efficiently, reducing wasteful exploration of the search space.

In conclusion, ($\boldsymbol{\mu}$, $\boldsymbol{\lambda}$)ES: The standard comma strategy is, in my opinion, the best generation update mechanism in evolutionary computation. It integrates multiple advantages, offers flexibility and adjustability, maintains population diversity, and improves convergence speed simultaneously.