INF3490 exercise answers - week 2 2014

Problem 1

- Binary representation
  - Bit-flip mutation
  - N-point and uniform crossover
- Integer representation
  - Random reset and creep mutation
  - N-point and uniform crossover
- (Cardinal/enumerated/symbolic representation)
  - Random reset mutation
  - N-point and uniform crossover
- Real-valued/continuous representation
  - Uniform and Gaussian (normally distributed) mutation
  - N-point, uniform (discrete) and arithmetic (intermediate, single, whole, etc.) crossover
- Permutation representation
  - Swap, insert, scramble and invert mutation
  - Partially mapped, order, cycle and edge crossover
- Tree representation
  - Mutation by random replacement
  - Subtree swap mutation

Problem 2

The probability of zero bit-flips is $\left(\frac{3}{4}\right)^4 = \frac{81}{256} \approx 0.316$. There are 4 ways to get one bit flip, each of which has a probability $\frac{1}{4}\left(\frac{3}{4}\right)^3$, so the probability of exactly one bit-flip is $\frac{4}{4}\left(\frac{3}{4}\right)^3 = \frac{27}{64} \approx 0.422$. Then the probability of getting more than one bit-flip is $1 - \frac{81}{256} - \frac{27}{64} = \frac{67}{256} \approx 0.262$.

Problem 3

Parents$(2, 4, 7, 1, 3, 6, 8, 9, 5)$ and $(5, 9, 8, 6, 2, 4, 1, 3, 7)$:

- Partially mapped crossover:$(5, 9, 1, 4, 3, 6, 8, 2, 7)$ and $(3, 6, 7, 8, 2, 4, 1, 9, 5)$
- Order crossover: $(9, 2, 4, 1, 3, 6, 8, 7, 5)$ and $(7, 1, 3, 6, 2, 4, 1, 9, 5)$
- Cycle crossover: $(2, 4, 7, 1, 3, 6, 8, 9, 5)$ and $(5, 9, 8, 6, 2, 4, 1, 3, 7)$