Midterm Exam #1 Formula Sheet

1. **Expected value ($E(W)$) and variance (σ_W^2)**
   - $E(W) = \sum_{s=1}^{n} p_s W_s$, where p_s = the probability of state s and W_s = state s wealth, and
   - $\sigma_W^2 = \sum_{s=1}^{n} p_s (W_s - E(W))^2$.
2. **Expected Utility ($E(U(W))$)**
   - $E(U(W)) = \sum_{s=1}^{n} p_s U(W_s)$, where $U(W_s)$ = state-contingent utility of wealth.
3. **Certainty Equivalent of Wealth (W_{CE}) and Risk Premium (λ) - Two Methods**
   - <u>"Exact" Method</u>: Set $E(U(W)) = U(W_{CE})$ and solve for W_{CE}; then $\lambda = E(W) - W_{CE}$.
   - <u>Arrow-Pratt Method</u>: $\lambda = .5\sigma_W^2 R_A(E(W))$, where $R_A(W) = -U''(W)/U'(W)$. Then $W_{CE} = E(W) - \lambda$.
4. **Risk Pooling**
   - $\sigma_{L_p}^2 = \frac{\sigma^2}{n} + \frac{n-1}{n}\rho\sigma^2$, where n corresponds to the number of identically distributed insured risks, $\sigma_{L_p}^2$ corresponds to the average variance per insured risk, and ρ corresponds to the correlation between all pairwise combinations of n identically distributed insured risks.
5. **Mean-Variance Model**

   If variance is a "complete" risk measure, then $E(U(X_i)) > E(U(X_j))$ for all risk averse utility functions under the following set of conditions:

   - $E(X_i) > E(X_j)$ and $\sigma_{X_i} < \sigma_{X_j}$;
   - $E(X_i) > E(X_j)$ and $\sigma_{X_i} = \sigma_{X_j}$; and
   - $E(X_i) = E(X_j)$ and $\sigma_{X_i} < \sigma_{X_j}$.
6. **Stochastic Dominance Model**

   If X_i stochastically dominates X_j, then $E(U(X_i)) > E(U(X_j))$ for all risk averse utility functions. Here are the formal definitions for first and second order stochastic dominance:

   - <u>First Order Stochastic Dominance:</u> Investment i First Order Stochastic Dominates (FOSD) investment j if $F(X_{j,s}) \geq F(X_{i,s})$ for all s.
   - <u>Second Order Stochastic Dominance:</u> Investment i Second Order Stochastic Dominates(SOSD) investment j if $\sum_{s=1}^{n} (F(X_{js}) - F(X_{is})) > 0$.

Standard Normal Distribution Function

z	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Note: For negative values of z, first determine the probability of positive z ($N(z)$) and then calculate $1 - N(z)$ in order to obtain $N(-z)$.