RSM332 Formula Sheet - Midterm Exam 2022

1. **Present value**
   $PV = \frac{C_T}{(1+r)^T}$
2. **Future value**
   $FV = C_0(1+r)^T$
3. **PV of perpetuity**
   $PV = \frac{C}{r}$
4. **PV of annuity**
   $PV = \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right]$
5. **PV of growing perpetuity**
   $PV = \frac{C}{r-g}$
6. **PV of growing annuity**
   $PV = \frac{C}{r-g}\left[1 - \left(\frac{1+g}{1+r}\right)^T\right]$
7. **Effective rate at frequency f**
   $r_f = \frac{\bar{r}}{f}$
   Note: $\bar{r}$ is the stated or quoted rate.
8. **Effective annual rate (EAR)**
   $1 + r_a = (1+r_f)^f$
9. **Price of a bond using yield y**
   $$P = \frac{C}{y}\left(1 - \frac{1}{(1+y)^T}\right) + \frac{F}{(1+y)^T}$$
10. **Clean vs. dirty prices**
    Clean P = Dirty P − Accrued Interest
11. **Price of a bond using spot rates**
    $P = \frac{C}{(1+r_1)} + \frac{C}{(1+r_2)^2} + \cdots + \frac{C+F}{(1+r_T)^T}$
12. **Forward rate**
    $f_t = \frac{(1+r_t)^t}{(1+r_{t-1})^{t-1}} - 1$
13. **Macaulay duration**
    $$D = \sum_{t=1}^{T} t \times \frac{CF_t}{(1+y)^t}\frac{1}{P}$$
    $\frac{\Delta P}{P} \approx -D^{\star}\Delta y$
14. **Modified duration**
    $D^* = \frac{D}{1+y}$
15. **Properties of duration**
    $$D_{portfolio} = \sum_{n=1}^{N} \frac{PV_n}{PV_{portfolio}} D_n$$
16. **Hedging with duration**
    $D_{assets} = D_{liabilities}\frac{PV_{liabilities}}{PV_{portfolio}}$
17. **Credit spread**
    $def = y^* - y^G$
18. **Forward payoff at maturity**
    $f_T = S_T - F$
19. **No-arbitrage forward price**
    $F = S \times (1+r_T)^T$
20. **Call option payoff at maturity**
    $C_T = \max[0, S_T - X]$
21. **Put option payoff at maturity**
    $P_T = \max[0, X - S_T]$
22. **Put-Call parity**
    $C = P + S - \frac{X}{(1+r_T)^T}$
23. **Derivative pricing – replication**
    $\Delta = \frac{O_u - O_d}{S_u - S_d}$
    $B = \frac{S_u \times O_d - S_d \times O_u}{(S_u - S_d)}$
    $O = \Delta \times S + \frac{B}{(1+r_T)^T}$
24. **Option pricing Black-Scholes**
    $C = S \times N(d_1) - Xe^{-rT} \times N(d_2)$
    $P = Xe^{-rT} \times N(-d_2) - S \times N(-d_1)$
    $d_1 = \frac{ln\left(\frac{S}{Xe^{-rT}}\right)}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2}$
    $d_2 = d_1 - \sigma\sqrt{T}$