

**HW4**

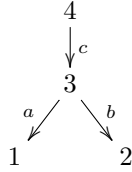
October 23, 2020 - Due Monday, November 2, 2020

1. Let  $R, S, T$  be rings. Let  ${}_S M_R$  be an  $S$ - $R$ -bimodule and  ${}_T N_R$  be a  $T$ - $R$ -bimodule. Prove that

$$\text{Hom}_R({}_S M_R, {}_T N_R) = \{f : {}_S M_R \rightarrow {}_T N_R \mid f \text{ is an } R\text{-module homomorphism}\}$$

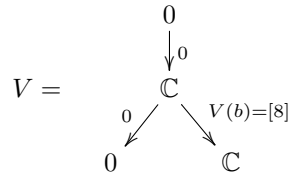
is a  $T$ - $S$  bimodule.

2. Let  $Q = (Q_0, Q_1, h, t)$  be the following quiver of type  $D_4$ :



- (a) Describe all indecomposable projective representations of  $Q$ .  
 (b) Describe all indecomposable injective representations of  $Q$ .

3. Consider the following representation of the above quiver  $Q$ :



- (a) Find a projective representation  $P$  and an epimorphism  $P \xrightarrow{p} V$   
 (b) Find the kernel of  $p$ .  
 (c) Find the canonical projective presentation of  $V$ .